PREVENTATIVE MEASURES WORK PLAN AGREEMENT PURSUANT TO INDIANA PETROLEUM RELEASE LAW

Amoco Corporation
Whiting, Indiana Refinery

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December 1996

AGREED ORDER SUBMITTAL CERTIFICATION

Submittal Description: *Preventative Measures Work Plan Agreement Pursuant to Indiana Petroleum Release Law*

I certify that the above submittal was prepared under my supervision according to current engineering practice and that to the best of my knowledge and belief it is complete and accurate.

signed: _____

certification no.: *PE60920342*

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ACRONYMS

AO	-	Agreed Order
Amoco	-	Amoco Corporation
AOC's	-	Area of Concern
BEI	-	Bascor Environmental, Inc.
BD	-	Boat Dock
BMWCI	-	Burns & McDonnell, Waste Consultants, Inc.
DQO's	-	Data Quality Objectives
ECI	-	Energy Cooperative, Inc.
FCU	-	Fluid Cracking Units
FPH	-	Free Phase Hydrocarbons
GPM	-	Gallon Per Minute
HDPE	-	High Density Polyethylene
IDEM	-	Indiana Department of Environmental Management
ISBL	-	Inside Battery Limits
J&L	-	Jones and Laughlin
NGVD	-	National Geodetic Vertical Datum
NFA	-	No Further Action
O&M	-	Operation and Maintenance
OSBL	-	Outside Battery Limits
PS	-	Pipestill
PR	-	Preliminary Review
RFI	-	RCRA Facility Investigation
RW	-	Recovery Well
RWGI	-	Refinery Wide Groundwater Investigation
SWMU	-	Solid Waste Management Unit
TGU	-	Tail Gas Unit
TSB	-	Technical Services Building
USEPA	-	U.S. Environmental Protection Agency
UST	-	Underground Storage Tanks
VRD	-	Vacuum Recovery Device
VES	-	Vapor Extraction System

VRU	-	Vapor Recovery Unit
VSI	-	Visual Site Inspection
VOC	-	Volatile Organic Compound
WWTP	-	Wastewater Treatment Plant
WCC	-	Woodward-Clyde Consultants

1.0 INTRODUCTION

1.1 OVERVIEW OF WORK PLAN

This Preventative Measures Work Plan (PMWP) has been prepared in response to Exhibit D, Facility Investigation for a Petroleum Release, Section X, Petroleum Facility Assessment Statement of Work, paragraph 17, Preventative Measures of the Corrective Action Order between Amoco Corporation and the State of Indiana effective December 8, 1995.

This plan identifies structural designs and methods of implementation of measures identified as being necessary to prevent future releases to the environment. This plan describes primarily the procedures for verifying the integrity of structures used to contain or transport hydrocarbon or hydrocarbon-containing materials.

In addition to this program, the facility operators are continually evaluating lines and systems for potential releases. When releases are detected, facility personnel perform immediate spill response and remediation activities. After the initial response, groundwater monitoring points (wells and piezometers) in the vicinity are observed to verify that containment of any released materials is maintained and that remediation/recovery is progressing. Additional piezometers and/or recovery systems are installed as needed based on evaluation of field data.

In terms of identifying the occurrence, extent, and locality of new or on-going releases, Amoco has instituted regular fluid level monitoring at selected monitoring well locations. This monitoring is supplemented by site-wide periodic fluid level monitoring. Field data from these programs are automatically processed and significant changes in water levels and free-phase hydrocarbon thickness are identified and evaluated. Conclusions are drawn regarding potential new sources of FPH and about the effectiveness of FPH control and recovery operations.

The PMWP describes the implementation of the preventative measures identified in Attachment to Exhibit D (Table 1-1) for areas of concern (AOC) including the refinery process sewer system, pipe alleys (including process piping), and dikes areas throughout tank fields. Due to the nature of performing numerous inspections and repairs at the complex facility of this size, including coordination of repairs with operation/production schedules running 24-hours a day, 365-days per year, the schedules included in the PMWP provide a range of time versus a task specific date of completion. The schedules will identify estimated time ranges to complete current ongoing studies, inspection plans, repair plans, and upgrades for the process piping, process sewers, and dike areas throughout tank fields.

Resources are allocated annually for the following year's planned work. It is anticipated that the requirements for cleaning and repair will be highly variable from system to system due to varying conditions of the utility and subsurface. Thus it is expected varying amounts of the system will be completed year by year as a result of the varying conditions.

Plans for evaluation of potential releases from former UST locations will be incorporated into petroleum release investigation plans. The following areas have been designated as requiring no further action at this time.

- Refinery Roads and Streets.
- Truck Garage Used Oil Satellite Accumulation System.
- Technical Services Building (TSB) Basement Ejection Sump.

Historical inspection and repair documentation will be maintained on file. IDEM will receive a final report on the refinery upgrades and testing plan implementation.

2.0 PROCESS PIPING AND PIPE ALLEYS

2.1 PIPING OVERVIEW

2.1.1 Main Refinery

The process piping and pipe alleys for the main refinery are shown in Figure 2-1. The pipe alleys are both above and below ground surface running between units at the refinery. The following list includes major units at the main refinery that have an associated process piping network. Unit acronyms are given in parentheses. Piping which runs between the units and into the tank field is called outside battery limits (OSBL). The piping which is located inside the battery limits (ISBL) are typically located inside the active units listed below. See the description of current conditions report (Woodward-Clyde Consultants and Burns & McDonnell, Waste Consultants, Inc., March 7, 1996) for additional details on these units.

- Alkylation Unit (2 Alky)
- Asphalt Plant
- Blending Oil Unit (BOU)
- Cat Feed Hydrotreater (CFHU)
- Crude Recovery Unit (CRU)
- Crude Station (CS)
- Distillate Desulfurizer Unit (DDU)
- FCU 500/600
- Hydro Finishing Unit (Hifi)
- Hydrogen Unit (HU)
- Isomerization Unit (2 UIU)
- Lubricant Base Stock Operations (LBSO)
- Methyl Ethyl Ketone (MEK)
- No. 11 Pipestill/Coker (11 PS)
- No. 12 Pipestill (12 PS)
- No. 37 Pipestill (37 PS)
- No. 3 Ultraformer (3 UF)
- No. 4 Ultraformer (4 UF)
- Power Stations
- Propylene Concentration Unit (PCU)
- Solvent Extraction Unit (SEU)
- Sulfur Recovery Unit (SRU)
- 2 Treating Plant
- 4 Treating Plant
- VRU 100
- VRU 200
- VRU 300
- Wax
- Xylene Aromatic Recovery Unit (ARU)

2.1.2 Tank Fields

The process piping and pipe alleys for the tank fields are shown in Figures 2-1 and 2-2. The following list includes the tank fields in the Refinery Area.

- Berry Lake Tank Field
- Indiana Tank Field
- South Tank Field
- South Tank Field Annex
- Stieglitz Park Tank Field

2.1.3 Buffalo Side

The Buffalo Side area is located to the north of the main refinery. The Buffalo Side contains two above ground storm water surge equalization tanks (T5050 and T5051). No process units, or pipe alleys are located at this area. Some process piping is in place that transports recovered oil from the wastewater treatment plant to the main refinery for reprocessing. These lines traverse the Buffalo Side property.

2.1.4 Dock Area

The process piping and pipe alleys for the Dock Area are shown in Figure 2-2. The pipe alleys are both above and below ground surface. The Dock Area is a transfer station for products to be loaded on barges or ships.

2.1.5 J&L Site

The process piping and pipe alleys for the J&L Site are shown in Figure 2-3. There are no process units at this location. The following list includes the tank fields at the J&L Site.

- Lake George Tank Field
- J&L Tank Field

- LPG Cavern
- Cal-Nitro Butane Spheres Tank Field

2.2 INSPECTION AND REPAIR PLAN

The refinery process piping network covers the active refinery and tank farm area of over approximately 1,200 acres of the total 1,700 acre refinery and J&L site. The refinery is conducting a piping inventory, inspection and maintenance program as outlined in Figure 2-4.

The PMWP for the Whiting Refinery OSBL piping systems includes five steps.

1. Identification of piping system.
2. Evaluation of existing piping during Piping System Studies.
3. Classification of piping for scheduling of detailed inspection and repair.
4. Planning and performance of inspections and repairs.
5. Reporting on plan progress.

2.2.1 Piping System Identification

The refinery is currently in the process of identifying all live (active) above or below ground piping in pipe alleys and tank fields outside battery limits (OSBL) of units. The OSBL piping is considered outside of the process unit boundaries. This piping can be either above or below ground piping. The piping networks inside battery limits (ISBL) are typically above grade and monitored as part of normal battery (or unit) operations. ISBL piping is, therefore, not included under this pipe identification program.

The scope of work is to identify the live above or below ground piping includes the following. This process began in 1995 and is anticipated to be completed in 1999.

1. Preparation of piping system list with priorities dependent on piping service and material (see Table 2-1).

2. Piping system priorities will be based on piping class and maintenance schedule.
3. Walkdown of piping from the tank fields to the units.
4. Below grade piping locations located during walkdown.
5. Creation/Updating of piping drawings.
6. Update refinery piping plan views and prepare piping system isometrics on an as-needed basis that show piping from tank fields to units.

Timing: 1995 - Listed Refinery OSBL Piping Systems.
1996 - Refinery Walkdown of piping and I.D. below grade locations.
1995 through 1999 - Create piping drawings.

A list of refinery piping systems has been compiled and a priority set based upon factors such as age and type of piping refinery maintenance schedules, type of product conveyed, extent of cathodic protection and field inspection results. The priority ranking groups similar systems together for evaluation and are adjusted periodically and will change based on refinery needs.

A preliminary walkdown (field survey) was completed in 1995, identifying below grade locations. Walkdown information will be used to update refinery piping plan views. Isometric drawings of piping systems will be prepared as needed to support piping system studies described below.

The refinery is currently preparing drawings derived from an aerial photograph taken of the refinery in 1995. The drawings will be drawn to a scale of 1 inch = 20 feet. A grid map will be prepared of the entire refinery area for reference.

2.2.2 Piping System Studies

The refinery is in the process of performing piping system studies with the purpose of evaluating process piping system groupings identified and listed in Table 2-2. Studies will review available piping system information such as plan views and isometric drawings.

Studies will attempt to identify potential improvement including elimination of dead legs and/or flanges. Studies are expected to be performed from 1996 through 2000.

2.2.3 Piping System Classification

The third step of the PMWP involves the assignment of classifications to the piping systems which will identify the required inspection frequency. Piping will be assigned a designation of Class 1, 2 or 3 according to the fluid service and location by definitions defined in API 570 with maximum inspection intervals as followed:

Class 1:	Thickness measurements and visual inspections every five years.
Class 2:	Thickness measurements every 10 years; visual inspections every five years.
Class 3:	Thickness measurements every 10 years; visual inspections every 10 years.

Information on system classifications and inspection/repair results will be maintained on file.

Inspection and repair plans will be developed based on these classifications to cover above ground, below ground, and at-grade piping. The above ground piping will include all live OSBL piping identified during the refinery wide pipe identification study. For purposes of PMWP focus will be entirely at grade and below ground piping. Below ground inspection and repair plans will include public road crossings, refinery property road crossings (including dike wall penetrations) and other underground piping. These plans will include provisions for continuation of the underground pipe raising project initiated in 1994. At-grade piping to be covered by inspection and repair plans includes tank basin piping and refinery pipe alleys. Classification work will be conducted in conjunction with the piping system studies described in section 2.2.2 and will continue through 2000.

2.2.4 Inspection and Repair Plans

2.2.4.1 Benchmark

Amoco is currently in the process of completing the description of the entire process piping network. Table 2-1 lists approximately 90 different systems that will be covered under the agreed order PMWP. The lengths of each of these systems is measured in miles. In addition, Amoco is compiling other data to provide a "benchmark" for planning inspection and repair of the system. Other benchmark data include quantity and linear feet for:

- public road crossings (estimated 600 each);
- underground lines;
- road crossings/dike wall penetrations within the refinery;
- tank basin (dike area) piping; and
- pipe alley square footage.

These benchmark data are currently being compiled and will be provided to IDEM in the implementation final report.

2.2.4.2 Priorities

Inspection and repair priorities will be set for the system described by the benchmark data according to the following criteria.

- Piping system study recommendations (see Section 2.2.2).
- API classification of piping (see Section 2.2.3).
- Groundwater monitoring data.
- Refinery unit "turn-around" maintenance schedules.
- Need for replacement of temporary repairs.
- Results of visual above grade inspections.

2.2.4.3 Plan Requirements

Piping inspection and repair plans will be developed and scheduled based on the recommendations from current piping system studies and upon the results of most recent inspections. Plans will include either pressure testing or external pipe wall thickness measurements for underground piping. In addition, replacement of any temporary piping repairs will be planned to coincide with maintenance at the related process unit. Additional details are provided below.

2.2.4.3.1 Underground Piping

Public Road Crossings

Live (active) piping under public roadways will be replaced based on the priorities dependent on existing piping age and public roadway authority road repair plans. New piping will be coated and cathodically protected if it is placed underground.

Refinery Road Crossings

Road crossings on refinery property are defined as live OSBL piping which runs underground through refinery roads or dike walls and is under 100 feet in length. Required repairs will be determined based on inspection results. Such repairs will utilize the most current and cost effective technology available to minimize external corrosion. Repair techniques will be constantly evaluated during the course of the inspection and repair project and will likely include coating and cathodic protection.

Other Underground Lines

Other underground lines are defined as live hydrocarbon OSBL piping which runs greater than 100 feet in length. Such piping will be raised to run at grade through dike walls or overhead on foundations and stanchions whenever possible.

2.2.4.3.2 At Grade Piping

Tank Basins

Piping at grade within tank dike areas will be inspected and repaired as required. Dead piping will be eliminated wherever possible. Accumulated soil will be removed from beneath the piping to provide clearance to ground. Pipe sleepers and other supports will be repaired or replaced as required. Piping will be sandblasted and painted in select areas.

Proper drainage will be established in recessed pipe alleys to remove standing water which creates a potential for piping corrosion. After restoration, pipe alleys will be evaluated for potential containment structures.

Pipe Alleys

At grade piping in the refinery pipe alleys will also be inspected and repaired as required. Dead piping will be eliminated wherever possible. Accumulated soil will be removed from beneath the piping to provide clearance to ground. Pipe sleepers and other supports will be repaired or replaced as required. Piping will be sandblasted and painted in select areas.

Proper drainage will be established in recessed pipe alleys to remove standing water which creates a potential for piping corrosion. After restoration, pipe alleys will be evaluated for potential containment structures.

Spill Response/Remediation

The refinery has prepared spill prevention and emergency response plans that guide in the event of spills in the pipe alleys. For surface releases, these plans include provisions for immediate vacuuming of hydrocarbon fluids and to the extent feasible, removal of impacted soils from the ground surface. For subsurface releases, if determined appropriate, Amoco constructs recovery sumps, wellpoint systems, recovery wells, or uses other methods to speed up the recovery of free phase hydrocarbons released to the groundwater. Residual subsurface free phase remaining after immediate spill response is

managed consistent with ongoing remediation activities. The status of these activities is reported in quarterly reports to IDEM.

The refinery is currently in the process of a multi-year upgrading of existing piping as described above. Different areas are evaluated based on a priority ranking. If circumstances warrant (if numerous flanged connections are present, for example) containment may be considered for the area. In some cases, options for construction of containment are limited because the shallow groundwater table does not allow the required clearances.

2.2.4.4 Schedule

The schedule for implementation of the PMWP is provided in Figure 2-5. Initial inspection of piping was begun in 1994 and is expected to continue until approximately 2010. Repairs and upgrading of the piping system will follow initial inspections and are expected to continue into 2014. Pipe alley excavations and restorations will be conducted concurrently but independently.

3.0 PROCESS SEWER

3.1 PROCESS SEWER DESCRIPTION

The refinery process sewer system collects all process unit waste water, surface water runoff, and discharge from groundwater control systems. The process sewers are divided into two major groups.

- Main process sewers.
- Branch lines.

The main process sewers consist of approximately six miles of various diameter pipes up to 84" diameter pipelines (see Figure 3-1). The types of material include steel, cast iron, acid brick within concrete, concrete and clay. The installation of these sewers dates back to the 1930's, 1940's and 1950's with modifications and repairs through the more recent years. All water is piped to the Lakefront Waste Water Treatment Plant (WWTP) for treatment and discharged through NPDES Outfall Number 2 to Lake Michigan. Note that refinery stormwater catch basins and connecting lateral lines and sanitary sewer lines are not included in the PMWP because they are not in hydrocarbon service.

3.2 PREVENTATIVE MEASURES PLAN DESCRIPTION

Amoco is currently conducting a cleaning program for main process sewers. This plan calls for the cleaning of main sewer lines on a five-year frequency. Under the terms of the AO, this program, Amoco is supplementing the cleaning program with a comprehensive cleaning inspection plan and repairs if needed that will evaluate the entire process sewer system including laterals up to process unit limits (See Figure 3-2).

The Amoco's preventative maintenance plan includes the main process sewer lines and the lateral connections for refinery process units, and the lateral connections from refinery process units. These will be cleaned, inspected and repaired as required based on a

prioritization that considers the following: 1) sewer construction type and materials, 2) product type carried, and 3) elevation with respect to groundwater.

3.3 PLAN PROCESS

The process sewer PMWP includes the elements shown in Figure 3-3. An inspection plan was developed with lines assigned priority as described above. Before inspections can be performed, manholes have to be identified for access at the limits of the line to be inspected. If necessary, the manholes will be enlarged for inspection and cleaning. In some cases, by-pass pumping must be arranged before the sewer is taken out of service.

Sludge removal will then be initiated. The Amoco plan assumes that sewer lines may be up to 25 percent full of sludge that must be properly handled and disposed.

Sludge removal will progress from the laterals, down into main sewer lines, to convenient end points such as junction boxes. After sludge has been removed, sewer interior walls (pipelines and structures) will be inspected and/or tested, typically by remotely piloted closed-circuit television (CCTV). Lines smaller than 4 inches internal diameter will be tested by other means which may include hydro static testing. Defects will be noted and repairs planned on an as-needed basis. See Appendix 3-1 for additional details of the plan.

Amoco will perform any required repairs as soon as possible after cleaning and inspection is complete. The extent of required repairs is unknown at this time, and it is anticipated that the entire six miles of main sewers and lateral lines may require up to 25 years to complete. This is due in part to the complexity and size of the process sewer system and the need to schedule repairs immediately after cleaning. Inspection maintenance program to start the construction season following approval of the work plan (see Figure 3-3).

4.0
STORAGE TANK AREAS

4.1 OVERVIEW

The refinery has numerous above ground storage tanks that contain crude oil and refined products. Table 4-1 is a listing of all the tanks at the refinery and contains the following information.

- Location: Main Refinery, Tank Field, Buffalo Side, Dock Area, and J&L Site.
- Three or four digit Refinery Tank No. I.D.

The PMWP includes ongoing tank maintenance and modernization activities and internal and external inspection programs. Repairs will be made as a result of inspections results.

Ongoing Maintenance and Modernization

As part of normal operation, tanks are externally inspected on a monthly basis by tank field operators. In addition, the refinery is conducting a modernization/upgrade program for selected tanks based on factors such as age, type of construction, and product type stored.

Industry Standards Initial Inspections

Following the initial inspections, continued inspections will be conducted at intervals based on industry standards. Industry standards internal inspection frequencies are based on three criteria:

- Operational information such as the type of product stored.
- Inspection data such as measured corrosion rates.
- Environmental factors such as air emission seal maintenance needs.

Repairs

Some tank repair and upgrades are already defined as part of the tank modernization program. It is anticipated that additional upgrade needs will be identified during continued internal and external inspections. These will be made on an as-needed basis.

4.2 TANK DIKE AREA TESTING PLAN

The refinery is testing product storage tanks based on historical and current information on the tanks. The tank inspection program is based on the American Petroleum Institute "Standards for Tank Inspection, Repair, Alteration, and Reconstruction." This standard reflects the accumulated knowledge and experience of tank owners, operators, manufactures and repairers of steel storage tanks. This covers carbon and low alloy steel tanks built to Industry standards for oil storage. Industry standards propose minimum requirements for maintaining the integrity of welded or riveted, non-refrigerated, atmospheric pressure, aboveground storage tanks after they have been placed in service. They cover the maintenance, inspection, repair, alteration, relocation, and reconstruction of such tanks.

Monthly External Inspections

Visual inspection are currently performed by the refinery. The interval of such inspections are approximately one month. This routine in-service inspection includes a visual inspection of the tank's exterior surface for:

- Leaks
- Corrosion
- Condition of foundation
- Condition of insulation systems
- Condition of floating or fixed roof
- Shell distortions
- Signs of settlement
- Condition of paint coatings
- Condition of appurtenances
- Condition of stairs

Industry Standards External and Internal Inspections

Formal visual external inspection by a certified inspector following industry standards will be done at a frequency of once every five years. This external inspection will include observations for the following:

- Condition of foundation
- Condition of stairs
- Condition of attached piping
- Condition of paint coatings
- Condition of insulation
- Condition of gauging system
- Condition and thickness of shell
- Condition of shell appurtenances
- Condition of windgirder
- Condition of IFR or EFR and roof appurtenances
- Level of floating roof
- Condition of tank roof seal
- Condition and thickness of fixed roof, condition of appurtenances
- Exterior condition of welds

Formal internal inspection by a certified inspector will also be performed for each tank over the next several years. After the initial inspection, intervals for future internal inspections will be determined by corrosion rates measured during the initial inspections, but will not exceed 20 years. In addition to a review of the previous external inspection items, this internal inspection shall include observations for the following:

- Condition of bottom interior surface
- Condition of bottom underside surface.
- Condition of bottom coatings if applicable
- Condition of shell interior surface and welds
- Condition of tank shell appurtenances
- Condition of internal piping
- Condition of floating roof underside surface
- Condition of floating roof seal systems
- Condition of floating roof appurtenances
- Condition of floating roof supports
- Condition of fixed roof interior surface
- Condition of fixed roof support structure

- Condition of all access structures
- Internal condition of welds

Repairs

All repairs, alterations, or reconstruction work performed as a result of these inspections will be done based on industry standards. The definition of these terms are:

- Alteration — Any work on a tank involving cutting, burning, welding or heating that changes the physical dimensions and/or configuration of a tank.
- Reconstruction — The work necessary to reassemble a tank that has been dismantled and relocate it to a new site.
- Repair — Any work necessary to maintain or restore a tank to a condition suitable for safe operation.

Records

Inspection records form the basis of the scheduled inspection and maintenance program. (It is recognized that records may not exist for older tanks and judgments may be based on experience with tanks in similar services.) The refinery maintains a file consisting of three types of records:

- Construction Records — Construction records may include nameplate information, drawings, specifications, construction completion report and any results of material tests and analyses.

- Inspection History — The inspection history includes all measurements taken, the condition of all parts inspected, and a record of all examinations and tests. A complete description of any unusual conditions with recommendations for correction or details which caused the conditions shall also be included. This file will also contain corrosion rate and inspection interval calculations.

- Repair/Alteration History — The repair/alteration history includes all data accumulated on a tank from the time of its construction with regards to repairs, alterations, replacements. These records should include the results of any experiences with coatings and linings.

5.0

INSPECTION AND REPORTING DATA MANAGEMENT

5.1 DATA MANAGEMENT RECORDS

The refinery will maintain files to contain OSBL piping, and process sewers data.

5.2 DATA MANAGEMENT FORMAT

The refinery will track testing plan progress and modifications to OSBL piping and process sewers. The tracking system is currently being developed and will not be completed until 1998.

Tank dike area information is currently tracked separately. This information will also continue to be maintained by the refinery.

6.0 SCHEDULE FOR REPORTING

6.1 IDEM FINAL REPORT

The PMWP will be implemented within 90 days of approval and a final report on implementation will be within 180 days of approval. Amoco will continue to perform routine inspections and actions as described in this plan. Amoco will inform IDEM if significant changes are required in the plan.

7.0 REFERENCES

Amoco Corporation, Whiting, Indiana Refinery RCRA Facility Investigation Description of Current Conditions, March 7, 1996, Woodward-Clyde Consultants and Burns & McDonnell, Waste Consultants, Inc.

IDEM and Amoco Oil Company, Whiting Refinery, Corrective Action Agreed Order, Cause No. H-11187.

TABLES

TABLE 1-1

ATTACHMENT TO EXHIBIT D
AOC CORRECTIVE ACTIONS
AGREEMENT PURSUANT TO INDIANA PETROLEUM RELEASE LAW

Areas of Concern and Corrective Actions that relate to releases to be treated under Exhibit D (Agreement Pursuant to Indiana Petroleum Release Law IC, 13-7-20.1, for a Facility Investigation for a Petroleum Release):

AOC		CORRECTIVE ACTION
(1)	Refinery Process Sewer System, consisting of steel, cast-iron, and concrete piping located beneath the entire facility (including the J&L Site, the Buffalo Side, the tank fields, and the Dock Area), which carries process wastes, contaminated rinse waters, contaminated storm water, contaminated groundwater pumped by the wellpoint systems, liquids from dewatering of special wastes, and other materials to the Lakefront Wastewater Treatment facility. This system includes all sumps (gravity and lift station types), including sumps located at the Docks Area and the Buffalo Side, leading to the Refinery process sewer system.	PREVENTATIVE MEASURE: Develop a plan to determine the occurrence, extent, and locality of on-going releases of oils and oily wastes from the process sewer system. This plan should evaluate potential methods of conducting an integrity test of the system. This plan should include the sumps and sewers located at the Refinery Area, the J&L Site, the Buffalo Side, the tank fields, and the Dock Area.
(2)	Pipe Alleys, which consist of excavations located along roads and between units throughout the Refinery.	PREVENTATIVE MEASURES: Develop a plan of action for the investigation and remediation of new or on-going releases from the pipe alleys including the maintenance of proper clearance and drainage for corrosion protection of the pipes. Develop a plan to evaluate below grade lines that will include either a program for integrity testing of those lines that remain below grade or raising lines to be above grade. Evaluate potential containment structures that might be built to prevent future piping leaks from having direct contact with surficial soils.

TABLE 1-1

AOC		CORRECTIVE ACTION
(3)	Diked areas throughout tank fields.	PREVENTATIVE MEASURES: Develop a plan of action for the investigation and remedation of new or on-going releases from the diked areas in the tank fields.
(4)	Sites of former underground storage tanks, which have been removed. a. 8,000 gallon fiberglass tank that held gasoline in the Refinery garage area. Tank was removed in 1989. b. 2,000 gallon fiberglass tank that held diesel and gasoline in the Refinery garage area. Tank was removed in 1990. c. 2,000 gallon steel tank that held waste petroleum product at the Technical Services Building. Tank was removed in 1989. d. 1,000 gallon steel tank that held no. 6 fuel in the southeast portion of the Refinery. Tank was removed in 1989. e. 1,500 gallon steel tank that held petroleum products in the south tank field. Tank was removed in 1990.	Incorporate into the Petroleum Investigation (Exhibit D) a plan to specifically investigate potential releases from these removed underground tanks. This plan should evaluate whether releases of petroleum and/or petroleum related products are concentrated near former tank sites. Respondent may submit existing sampling data to demonstrate that there was no release from underground tanks at these sites. If information indicates that a plume of free-phase petroleum overlaps any or all of these areas, these areas will be incorporated into the general Petroleum Investigation.
(5)	Refinery Roads/Streets System, located throughout the Facility which have received routine and systematic releases from trucks, process units, equipment, and loading and unloading areas.	No further action at this time.
(6)	Truck Garage Used Oil Satellite Accumulation System and Area.	No further action at this time.
(7)	Technical Services Building (TSB) Basement Ejection Sump Area, in the northwest corner of the TSB basement.	No further action at this time.

TABLE 2-1

OSBL PIPING SYSTEM IDENTIFICATION

System Group	System Name
Black Oils	Crude Oil
Butanes	Butane/Butylene (BB)
Butanes	Iso-Butane
Butanes	NC4 - From Alky
Butanes	SAT Butane -From VRU 300 & Spheres
Propanes	UF Propane
Gas Oils	Coke Still Gas Oil (CSGO)
Gas Oils	Heavy Vacuum Gas Oil (HVGO)
Gas Oils	Light Vacuum Gas Oil (LVGO)
Gas Oils	Primary Gas Oil (PGO)
Gas Oils	Trim Gas Oil (TGO)
Black Oils	Resid
Black Oils	Decanted Oil (DCO)
Distillates	Dist To BOU (262L)
Distillates	Light Cat Cycle Oil (LCCO)
Naphthas	Regular Absorption Naph (RAN)
Naphthas	Wild Gasoline - FCU to VRU
Utility Systems	Amine
Naphthas	Stabilized Heavy/Light&Heavy Cat Naph (SHN, LCN, HCN)
Utility Systems	Light Slop
Distillates	CRU Feed
Distillates	CRU LSHO
Distillates	CRU HSFO Base
Ultraformates	Polymer
Distillates	Wild Kerosene
Naphthas	Heavy Virgin Naph (HVN)
Utility Systems	Sour Water
Distillates	BOU Dist Product
Gas Oils	SEU Extract
Naphthas	Light Virgin Naph (LVN)
Naphthas	Intermediate Virgin Naph (IVN)
Distillates	Heavy Middle Dist (HMD)
Distillates	Light Middle Dist (LMD)
Utility Systems	Wet Gas - To VRU 100/200
Utility Systems	Wet Gas - To VRU 300
Naphthas	Debutanized Light Naph (DBN)
Naphthas	3# Naph
Naphthas	Coke Still/CRU/Ison Naph (CSN, CRU/Isom Light Naph)
Isomerization	Isomerate
Distillates	Coke Still Dist (CSD)
Naphthas	Gasoline/Naph Transfer (102L)
Gasolines	#1 Blender - Silver/Regular
Gasolines	#2 Blender - Regular
Gasolines	#3 Blender - Ultimate
Ultraformates	Special Components
Ultraformates	Total UF (TUF)
Ultraformates	Light UF (LUF)

TABLE 2-1

OSBL PIPING SYSTEM IDENTIFICATION

System Group	System Name
Ultraformates	Heavy UF (HUF)
Ultraformates	Heavy Heavy UF (HHUF)
Ultraformates	Xylene
Naphthas	Debutanized Absorption Naph (DAN)
Naphthas	Dehexanizer Naph (DEHEX)
Naphthas	Sharp Cut Naph (SCN) (6# Naph)
Naphthas	2# Naph
Alkylation	Alkylate
Propanes	Propane/Propylene (PP) - To PCU
Propanes	Liquid Propane Gas (LPG)
Propanes	Polymer Grade Propylene (PGP)
Propanes	Refinery Grade Propylene (RGP)
Propanes	Off Spec Propane
Distillates	DDU LSFO Product
Distillates	DDU PDF Product
Naphthas	Light Naph - DDU
Naphthas	Naph Spills (159L)
Utility Systems	Fuel Gas
Utility Systems	Flare
Gas Oils	Dirty Gas Oil (DGO)
Gas Oils	Lube Oil - To Docks
Distillates	Dist Transfer (LGTF)
Distillates	HSFO Product
Distillates	JP8 Product
Distillates	Jet-A Product
Gasolines	Gasoline Slop - 3531 Tank
Gasolines	Mineral Spirits
Gasolines	South Gas Transfer (SNG)
Gasolines	Gasoline Transfer (North Gas, DAN Tran. ROW)
Purchased Stocks	MTBE
Purchased Stocks	Ethanol
Purchased Stocks	Gasoline Additives
Purchased Stocks	Distillate Additives
Pipelines	Westshore
Pipelines	Badger
Pipelines	Enron/DNG
Pipelines	Buckeye
Pipelines	Clark, Toluene, Raffinate
Utility Systems	Process Sewers
Utility Systems	Dist. Tank Water Draw
Utility Systems	Gasoline Tank Water Draw

Note: Utility piping systems used for transportation of non-petroleum products were excluded from this list. They include utility piping lines for hydrogen, oxygen, natural gas, Once Through Cooling Water (OTCW), air, steam, and nitrogen lines.

TABLE 2-2

PROCESS PIPING SYSTEM GROUPINGS

Black Oils 01	Naphtha's 04	Gasolines 08	Pipelines 12
Crude Oil 01	Heavy Virgin Naphtha (HVN) 01	Wild Gasoline - FCU to VRU 01	Westshore 01
Resid 02	Light Virgin Naphtha (LVN) 02	Gasoline Slop - 3531 Tank 02	Badger 02
Decanted Oil (DCO) 03	Intermed, Virgin Naphtha (IVN) 03	#3 Blender - Ultimate 03	Enron 03
Gas Oils 02	CSN, CRU/Ison Lght Naphtha 04	#2 Blender - Regular 04	Buckeye 04
Trim Gas Oil (TGO) 01	Reg. Absorption Naphtha (RAN) 05	#1 Blender - Silver/Reg. 05	Clark 05
PGO, HVGO, LVGO, CSGO 02	Debutanized Abs. Nap. (DAN) 06	Mineral Spirits 06	**Utility Systems 13**
Dirty Gas Oil 03	Dehexanizer Nap (Dehex) 07	South Gas Transfer (SNG) 07	Flare 01
Distillates 03	Debutanized Light Nap (DBN) 08	Row Line 08	Sour Water 02
Heavy Middle Dist. (HMD) 01	Sharp Cut Naphtha (SCN) 09	**Butanes 09**	Amine 03
Light Middle Dist. (LMD) 02	3# Naphtha 10	Butane/Butylene (BB) 01	Hydrogen 04
Light Cycle Cat Oil (LCCO) 03	2# Naphtha 11	Sat Butane 02	Oxygen 05
Coke Still Dist. (CSD) 04	SHN, LCN, HCN 12	NC4 from Alky 03	Fuel Gas 06
Dist. to BOU (262L) 05	Light Naphtha DDU 13	Isobutane 04	Natural Gas (NIPSCO) 07
SEU Extract 06	Gas/Naphtha Transfer (102L) 14	**Propanes 10**	Light Slop 08
Dist. Transfer (LGTF) 07	Naphtha Spills 15	Liquid Propane Gas (LPG) 01	Wet Gas to VRU 300 09
CRU Feed 08	**Ultraformates 05**	Polymer Grade Propylene (PGP) 02	Wet Gas to VRU 100/200 10
Wild Kerosene 09	Total UF (TUF) 01	Refinery Grade Prop. (RGP) 03	Electrical 11
BOU Dist. Product 10	Light UF (LUF) 02	Propane/Propylene (PP) 04	Process Sewers 12
DDU LSFO Product 11	Heavy UF (HUF) 03	UF Propane 05	Dist. Tk Water Draw 13
DDU PDF Product 12	Heavy Heavy UF (HHUF) 04	Off Spec Propane (06)	Gas Tk Water Draw 14
CRU LSHO 13	Xylene 05	**Purchased Stocks 11**	OTCW 15
CRU HSFO Base 14	Polymer 06	MTBE 01	Air 16
HSFO Product 15	Special Components 07	Ethanol 02	100# Steam 17
JP8 Product 16	**Isomerization 06**	DNG 03	400# Steam 18
Jet-A Product 17	Isomerate 01	Toluene 04	15# Steam 19
Lube Oil - to Docks 18	**Alkylation 07**	Raffinate 05	
	Alkylate 01	Gasoline Additives 06	
		Distillate Additives 07	

TABLE 3-1

Amoco Whiting Refinery Main Process Sewer Lines Inventory				
Main Sewer Size	Sewer Description and Location	Length (ft.)	Year Cleaned	Nominal Size
Main	From junction N. of cats north to 84" tie-in	2,300	1995	72"
72"	Cat Complex laterals, (incl. VRUs)	2,000	1993	18 thru 60"
72"	ITF/Gate 20 West leg to junction N. of cats	1,075	1993	24", 30"
72"	4CTP East leg to junction north of cats	1,650	1994	36", 48"
72"	UIU West lateral north of Alky Unit	950	1995	30"
72"	SRU lateral north of unit	1,000	1995	24", 30"B.
Main	From VRU 300 north to NE corner storehouse	3,675	1995	48"
48"	VRU 300 lateral east to unit	350	1995	24"
48"	12 PS lateral east to unit	975	1994	24, 30"
48"	Alky/SRU and Alky Casper laterals	1,070	1995	36"
48"	Mechanical Shops lateral	500	1995	36"
Main	From 4UF comp. past 72", north to 84" junction	1,750	Future	54"
54"	From zeolite and H2O treating, old brick sewers	500	Future	24"
54"	11PS C side	700	Future	24"
54"	4UF Complex main N-S lateral	700	Future	24"
Main	N-S run from S. of coke yard north to 84"junction	1,500	Future	4x6 oval
4x6	E-W brick sewer from 558tk west to 4x6 main	300	1994	24"
4x6	N.S. lateral from SW of BOU to 4x6W	1,700	Future	24"
4x6	From MEK to 4x6W	525	Future	18, 24"
4x6	HIFI Unit to 4x6W	300	Future	18"
4x6	"4x6 W. leg" east to 4x6 main	1,000	Future	36"
Main	Main, east from Gate 4 to main junction	1,285	Future	36"
36HO	Barrel House lateral to main	400	Future	30"
36HO	MOB laterals (2)	250	Future	18, 36"
36HO	Grease Works lateral	525	Future	24"
Main	From old HO office to junction	1,235	Future	36"
36Wax	Old Propane Dewaxing brick sewer	250	Future	24"B
36Wax	37/SEU lateral to main	100	Future	36"
36Wax	Wax Refinery lateral to main	300	Future	36"
Main	From junction north to the lakefront	1,000	Future	84"
84"	Collection lateral from main junction box west	925	Future	72"
84"	Collection lateral from main junction box east	900	Future	72"
TOTAL		29,390		

PREVENTATIVE MEASURES WORK PLAN
ABOVE GROUND STORAGE TANKS
TABLE 4-1

Location	Tank No.
MAIN REFINERY	
Main Refinery	3485
Main Refinery	3488
Asphalt Plant	23
Asphalt Plant	24
Asphalt Plant	26
Asphalt Plant	27
Asphalt Plant	78
Asphalt Plant	113
Asphalt Plant	114
Asphalt Plant	125
Asphalt Plant	126
Asphalt Plant	127
Asphalt Plant	128
Asphalt Plant	129
Asphalt Plant	134
Asphalt Plant	136
Asphalt Plant	145
Asphalt Plant	148
Asphalt Plant	149
Asphalt Plant	150
Asphalt Plant	152
Asphalt Plant	153
Asphalt Plant	155
Asphalt Plant	195
Asphalt Plant	220
Asphalt Plant	221
Asphalt Plant	222
Asphalt Plant	223
Asphalt Plant	224
Asphalt Plant	225
Asphalt Plant	226
Asphalt Plant	261
Asphalt Plant	262
Asphalt Plant	6201
Asphalt Plant	6202
Asphalt Plant	6203
Asphalt Plant	6204
Asphalt Plant	6248
Asphalt Plant	6249
Asphalt Plant	6250
Asphalt Plant	6251
Asphalt Plant	6252
Asphalt Plant	6253
LBSO	101
LBSO	106
LBSO	110
LBSO	112
LBSO	113

Location	Tank No.
LBSO	114
LBSO	115
LBSO	122
LBSO	125
LBSO	130
LBSO	131
LBSO	132
LBSO	139
LBSO	140
LBSO	142
LBSO	146
LBSO	147
LBSO	149
LBSO	156
LBSO	201
LBSO	203
LBSO	204
LBSO	601
LBSO	603
LBSO	604
LBSO	605
LBSO	606
LBSO	611
LBSO	612
LBSO	613
LBSO	615
LBSO	616
LBSO	617
LBSO	621
LBSO	622
LBSO	623
LBSO	624
LBSO	701
LBSO	702
LBSO	704
LBSO	705
LBSO	720
LBSO	721
LBSO	722
LBSO	723
LBSO	726
LBSO	727
LBSO	728
LBSO	729
LBSO	730
LBSO	732
LBSO	741
LBSO	742
LBSO	743
LBSO	745
LBSO	746
LBSO	747
LBSO	748
LBSO	749

Location	Tank No.
LBSO	750
LBSO	752
LBSO	753
LBSO	754
LBSO	757
LBSO	758
LBSO	765
LBSO	766
LBSO	767
LBSO	768
LBSO	769
LBSO	770
LBSO	774
LBSO	775
LBSO	776
LBSO	777
LBSO	778
LBSO	791
LBSO	792
LBSO	793
LBSO	794
LBSO	796
LBSO	797
LBSO	800
LBSO	801
LBSO	802
LBSO	803
LBSO	804
LBSO	824
LBSO	825
LBSO	826
LBSO	827
LBSO	851
LBSO	852
LBSO	853
LBSO	861
LBSO	871
LBSO	872
LBSO	877
LBSO	2190
LBSO	2191
LBSO	2192
LBSO	2193
LBSO	2239
LBSO	2240
LBSO	2241
Marketing (MOB)	106
Marketing (MOB)	149
Marketing (WAX)	783
Marketing (WAX)	820
Marketing (WAX)	821
Marketing (WAX)	822
Marketing (WAX)	828
Marketing (WAX)	829

Location	Tank No.
Marketing (WAX)	836
Marketing (WAX)	837
Marketing (WAX)	840
Marketing (WAX)	841
Marketing (WAX)	842
Marketing (WAX)	843
Marketing (WAX)	851
Marketing (WAX)	852
Marketing (WAX)	853
Marketing (WAX)	856
Marketing (WAX)	857
Marketing (WAX)	858
Marketing (WAX)	878
Marketing (WAX)	879
Marketing (Grease)	921
Marketing (Grease)	922
Marketing (Grease)	923
Marketing (Grease)	925
Marketing (Grease)	944
Marketing (Grease)	946
Marketing (Grease)	947
Marketing (Grease)	948
Marketing (Grease)	949
Marketing (Grease)	969
Marketing (Grease)	970
Marketing (Grease)	971
Marketing (Grease)	972
Marketing (Grease)	973
Marketing (Grease)	974
Marketing (Grease)	975
Marketing (#4 Comp)	1001
Marketing (#4 Comp)	1002
Marketing (#4 Comp)	1003
Marketing (#4 Comp)	1004
Marketing (#4 Comp)	1005
Marketing (#4 Comp)	1006
Marketing (#4 Comp)	1007
Marketing (#4 Comp)	1008
Marketing (#4 Comp)	1009
Marketing (#4 Comp)	1010
Marketing (#4 Comp)	1011
Marketing (#4 Comp)	1012
Marketing (#4 Comp)	1013
Marketing (#4 Comp)	1014
Marketing (#4 Comp)	1015
Marketing (#4 Comp)	1016
Marketing (#4 Comp)	1017
Marketing (#4 Comp)	1018
Marketing (#4 Comp)	1019
Marketing (#4 Comp)	1020
Marketing (#4 Comp)	1021
Marketing (#4 Comp)	1022
Marketing (#4 Comp)	1023
Marketing (#4 Comp)	1024

Location	Tank No.
Marketing (#4 Comp)	1025
Marketing (#4 Comp)	1028
Marketing (#4 Comp)	1029
Marketing (#4 Comp)	1030
Marketing (#4 Comp)	1031
Marketing (#4 Comp)	1032
Marketing (#4 Comp)	1101
Marketing (#4 Comp)	1102
Marketing (#4 Comp)	1103
Marketing (#4 Comp)	1107
Marketing (#4 Comp)	1108
Marketing (#4 Comp)	1109
Marketing (#4 Comp)	1110
Marketing (#4 Comp)	1112
Marketing (#4 Comp)	1113
Marketing (#4 Comp)	1114
Marketing (#4 Comp)	1115
Marketing (#4 Comp)	1116
Marketing (#4 Comp)	1117
Marketing (#4 Comp)	1118
Marketing (#4 Comp)	1121
Marketing (#4 Comp)	1122
Marketing (#4 Comp)	1123
Marketing (#4 Comp)	1124
Marketing (#4 Comp)	1125
Marketing (#4 Comp)	1126
Marketing (#4 Comp)	1127
Marketing (#4 Comp)	1128
Marketing (#4 Comp)	1129
Marketing (#4 Comp)	1130
Marketing (#4 Comp)	1131
Marketing (#4 Comp)	1132
Marketing (#4 Comp)	1133
Marketing (#4 Comp)	1134
Marketing (#4 Comp)	1135
Marketing (#4 Comp)	1136
Marketing (#4 Comp)	1137
Marketing (#4 Comp)	1138
Marketing (#4 Comp)	1139
Marketing (#4 Comp)	1140
Marketing (#4 Comp)	1141
Marketing (#4 Comp)	1142
Marketing (#4 Comp)	1143
Marketing (#4 Comp)	1144
Marketing (#4 Comp)	1145
Marketing (#4 Comp)	1146
Marketing (#4 Comp)	1147
Marketing (#4 Comp)	1150
Marketing (#4 Comp)	1151
Marketing (MOB)	2250
Marketing (MOB)	2251
Marketing (MOB)	2252
Marketing (MOB)	2253
Marketing (MOB)	2254

Location	Tank No.
Marketing (MOB)	2255
Marketing (MOB)	2256
Marketing (MOB)	2257
Marketing (MOB)	2258
Marketing (MOB)	2259
Marketing (MOB)	2260
Marketing (MOB)	2261
Marketing (MOB)	2262
Marketing (MOB)	2263
Marketing (MOB)	2264
Marketing (MOB)	2265
Marketing (MOB)	2266
Marketing (MOB)	2267
Marketing (MOB)	2268
Marketing (MOB)	2269
Marketing (MOB)	2270
Marketing (MOB)	2271
Marketing (MOB)	2272
Marketing (MOB)	2273
Marketing (MOB)	2274
Marketing (MOB)	2275
Marketing (MOB)	2276
Marketing (MOB)	2277
Marketing (MOB)	2278
Marketing (MOB)	2280
Marketing (MOB)	2281
Marketing (MOB)	2282
Marketing (MOB)	2300
Marketing (MOB)	2301
Marketing (MOB)	2302
Marketing (MOB)	2303
Marketing (MOB)	2304
Marketing (MOB)	2305
Marketing (MOB)	2306
Marketing (MOB)	2307
Marketing (MOB)	2308
Marketing (MOB)	2309
Marketing (MOB)	2310
Marketing (MOB)	2311
Marketing (MOB)	2312
Marketing (MOB)	2313
Marketing (MOBb)	2314
Marketing (MOBm)	2315
Marketing (MOBt)	2316
Marketing (MOBb)	2317
Marketing (MOBm)	2318
Marketing (MOBt)	2319
Marketing (MOBb)	2320
Marketing (MOBm)	2321
Marketing (MOBt)	2322
Marketing (MOB)	2323
Marketing (MOB)	2324
Marketing (MOB)	2325
Marketing (MOB)	2326

Location	Tank No.
Marketing (MOB)	2327
Marketing (MOB)	2328
Marketing (MOBb)	2329
Marketing (MOBm)	2330
Marketing (MOBt)	2331
Marketing (MOBb)	2332
Marketing (MOBm)	2333
Marketing (MOBt)	2334
Marketing (MOBb)	2335
Marketing (MOBt)	2336
Marketing (MOB)	2337
Marketing (MOB)	2338
Marketing (MOBb)	2339
Marketing (MOBt)	2340
Marketing (MOBb)	2341
Marketing (MOBt)	2342
Marketing (MOB)	2343
Marketing (MOB)	2344
Marketing (MOBb)	2345
Marketing (MOBt)	2346
Marketing (MOBb)	2347
Marketing (MOBt)	2348
Marketing (MOBb)	2349
Marketing (MOBt)	2350
Marketing (MOB)	2351
Marketing (MOB)	2352
Marketing (MOB)	2353
Marketing (MOB)	2354
Marketing (MOB)	2355
Marketing (MOB)	2356
Marketing (MOB)	2357
Marketing (MOB)	2358
Marketing (MOB)	2359
Marketing (MOB)	2360
Marketing (MOB)	2361
Marketing (MOB)	2362
Marketing (MOB)	2363
Marketing (MOBb)	2364
Marketing (MOBm)	2365
Marketing (MOBt)	2366
Marketing (MOB)	2367
Marketing (MOB)	2368
Marketing (MOBb)	2369
Marketing (MOBm)	2370
Marketing (MOBt)	2371
Marketing (MOBb)	2372
Marketing (MOBt)	2373
Marketing (MOBb)	2374
Marketing (MOBm)	2375
Marketing (MOBt)	2376
Marketing (MOBb)	2377
Marketing (MOBm)	2378
Marketing (MOBt)	2379
Marketing (MOBb)	2380

Location	Tank No.
Marketing (MOBm)	2381
Marketing (MOBt)	2382
Marketing (MOB)	2383
#1 Power Station	UT-2272
#1 Power Station	L-50
#3 Power Station	UT-3395
#3 Power Station	UT-3399
#3 Power Station	L-124
TANK FIELD	
Indiana Tank Field	3727
Indiana Tank Field	3726
Indiana Tank Field	3717
Indiana Tank Field	3720
Indiana Tank Field	3722
Indiana Tank Field	3723
Indiana Tank Field	3730
Indiana Tank Field	3706
Indiana Tank Field	3709
Indiana Tank Field	3710
Indiana Tank Field	3711
Indiana Tank Field	3712
Indiana Tank Field	3713
Indiana Tank Field	3714
Indiana Tank Field	3715
Indiana Tank Field	3716
Indiana Tank Field	3701
Indiana Tank Field	3702
Indiana Tank Field	3703
Indiana Tank Field	3704
Indiana Tank Field	3705
Indiana Tank Field	3706
Indiana Tank Field	3703
Indiana Tank Field	3728
Indiana Tank Field	3733
Indiana Tank Field	3734
Indiana Tank Field	3735
South Tank Field	3525
South Tank Field	3526
South Tank Field	3527
South Tank Field	3528
South Tank Field	3474
South Tank Field	3475
South Tank Field	3476
South Tank Field	3477
South Tank Field	3479
South Tank Field	3480
South Tank Field	3483
South Tank Field	3484
South Tank Field	CAVN
South Tank Field	3485
South Tank Field	3486
South Tank Field	3487
South Tank Field	3488
South Tank Field	3489

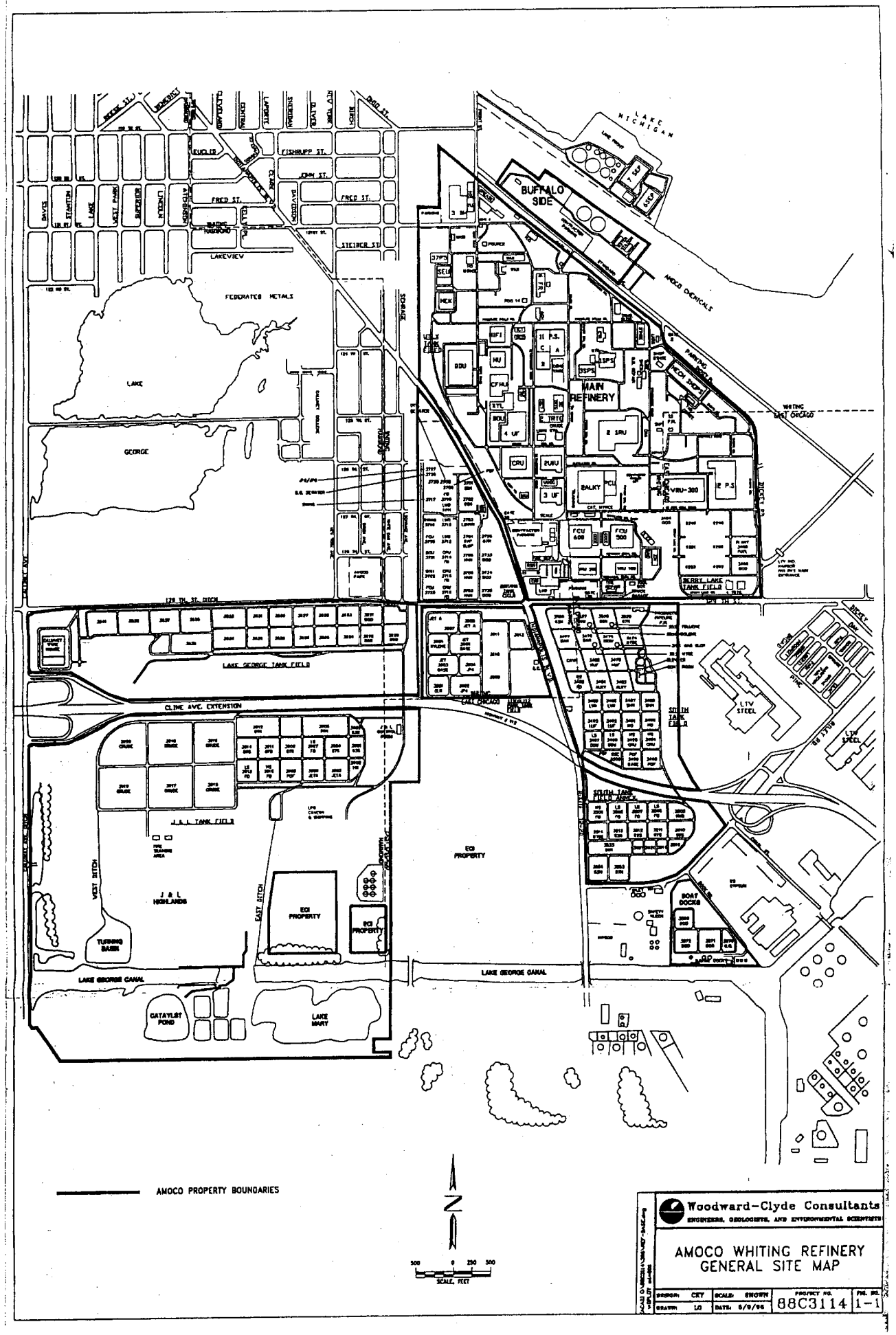
Location	Tank No.
South Tank Field	3490
South Tank Field	3491
South Tank Field	3492
South Tank Field	3493
South Tank Field	3494
South Tank Field	3495
South Tank Field	3496
South Tank Field	3497
South Tank Field	3498
South Tank Field	3499
South Tank Field	3500
South Tank Field Annex	3505
South Tank Field Annex	3506
South Tank Field Annex	3507
South Tank Field Annex	3508
South Tank Field Annex	3509
South Tank Field Annex	3510
South Tank Field Annex	3511
South Tank Field Annex	3512
South Tank Field Annex	3513
South Tank Field Annex	3514
South Tank Field Annex	3518
South Tank Field Annex	3519
South Tank Field Annex	3520
South Tank Field Annex	3521
South Tank Field Annex	3533
South Tank Field Annex	3553
South Tank Field Annex	3554
Stieglitz Park Tank Field	3601
Stieglitz Park Tank Field	3602
Stieglitz Park Tank Field	3603
Stieglitz Park Tank Field	3604
Stieglitz Park Tank Field	3606
Stieglitz Park Tank Field	3606
Stieglitz Park Tank Field	3607
Stieglitz Park Tank Field	3608
Stieglitz Park Tank Field	3609
Stieglitz Park Tank Field	3610
Stieglitz Park Tank Field	3611
Stieglitz Park Tank Field	3613
DOCK AREA	
Dock Area	3569
Dock Area	3570
Dock Area	3571
Dock Area	3572
J&L SITE	
Lake George Tank Field	3820
Lake George Tank Field	3821
Lake George Tank Field	3822
Lake George Tank Field	3823
Lake George Tank Field	3824
Lake George Tank Field	3824
Lake George Tank Field	3825
Lake George Tank Field	3826

Location	Tank No.
Lake George Tank Field	3827
Lake George Tank Field	3828
Lake George Tank Field	3829
Lake George Tank Field	3830
Lake George Tank Field	3831
Lake George Tank Field	3832
Lake George Tank Field	3833
Lake George Tank Field	3834
Lake George Tank Field	3835
Lake George Tank Field	3836
Lake George Tank Field	3837
Lake George Tank Field	3839
Lake George Tank Field	3841
J&L Crude Tank Field	3900
J&L Crude Tank Field	3901
J&L Crude Tank Field	3902
J&L Crude Tank Field	3903
J&L Crude Tank Field	3904
J&L Crude Tank Field	3905
J&L Crude Tank Field	3906
J&L Crude Tank Field	3907
J&L Crude Tank Field	3908
J&L Crude Tank Field	3909
J&L Crude Tank Field	3910
J&L Crude Tank Field	3911
J&L Crude Tank Field	3912
J&L Crude Tank Field	3913
J&L Crude Tank Field	3914
J&L Crude Tank Field	3915
J&L Crude Tank Field	3916
J&L Crude Tank Field	3917
J&L Crude Tank Field	3918
J&L Crude Tank Field	3919
J&L Crude Tank Field	3920

Note: API 653 inspections to be completed by 2010.
LBSO - Lubes Base Stock Operations.
MOB - Motor Oil Blending

H:\NED\PMWPTA1.XLS

FIGURES



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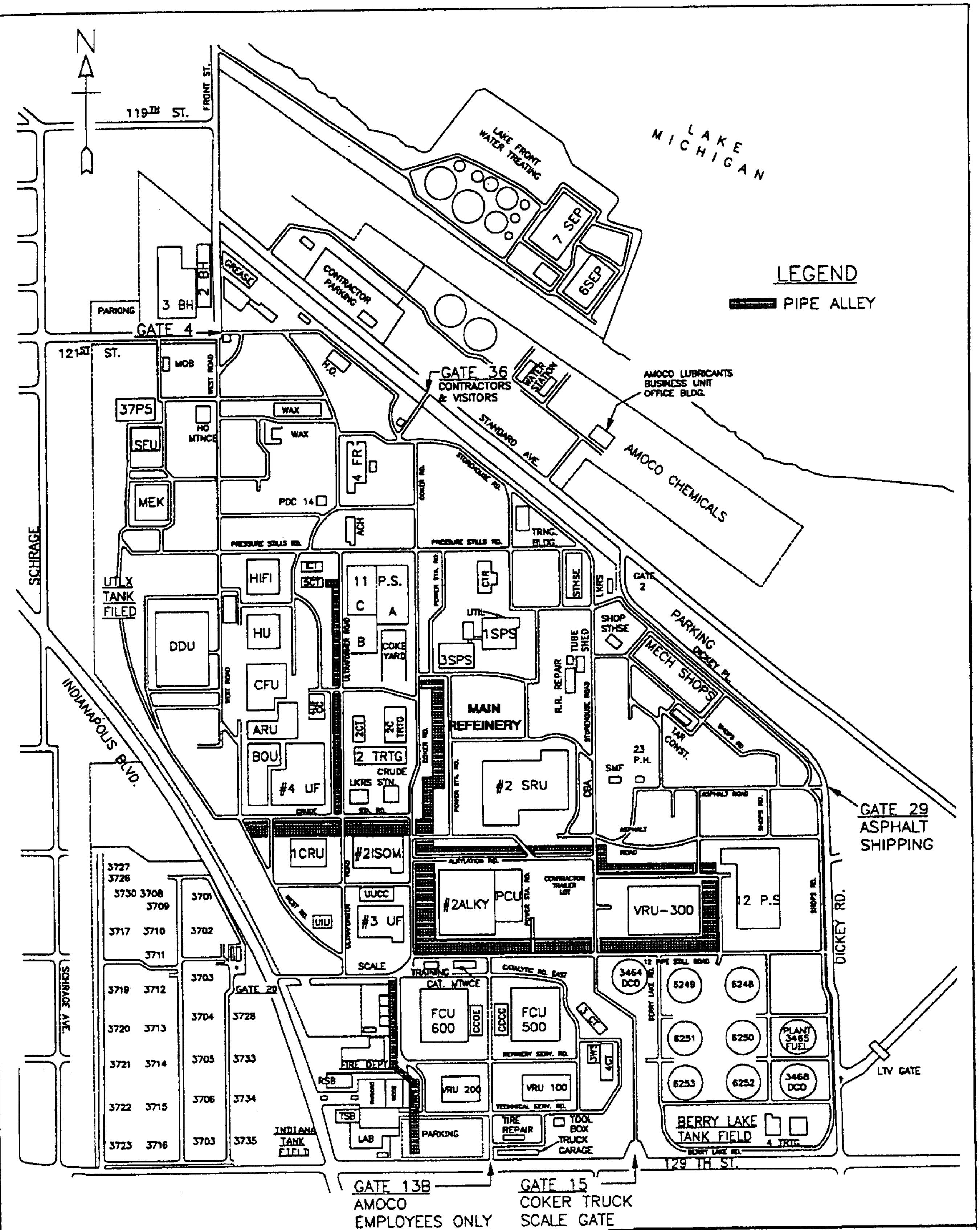
AMOCO WHITING REFINERY GENERAL SITE MAP

DESIGN: CKY	SCALE: SHOWN	PROJECT NO. 88C3114	FIG. NO. 1-1
DRAWN: LG	DATE: 6/9/95		



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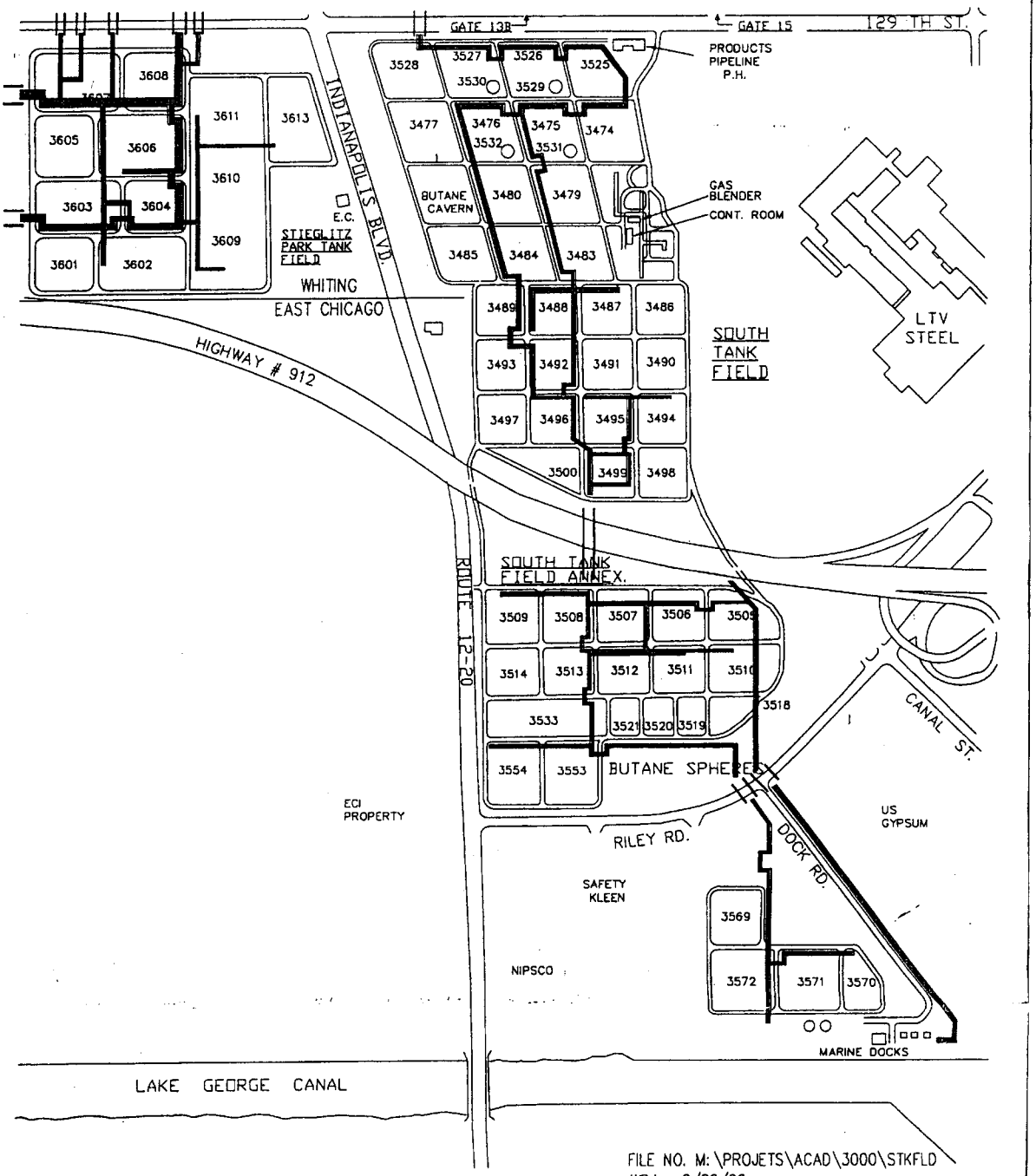
AMOCO WHITING REFINERY
PIPE ALLEYS FOR THE MAIN REFINERY, INDIANA TANK FIELD AND BUFFALO SIDE AREAS

DESIGN: CEY	SCALE: NONE	PROJECT NO.	88C3114	FIG. NO.	2-1
DRAWN: LM	DATE: 6/4/98				



FILE NO. M:\PROJETS\ACAD\3000\STKFLD
WDJ 2/26/96

LEGEND

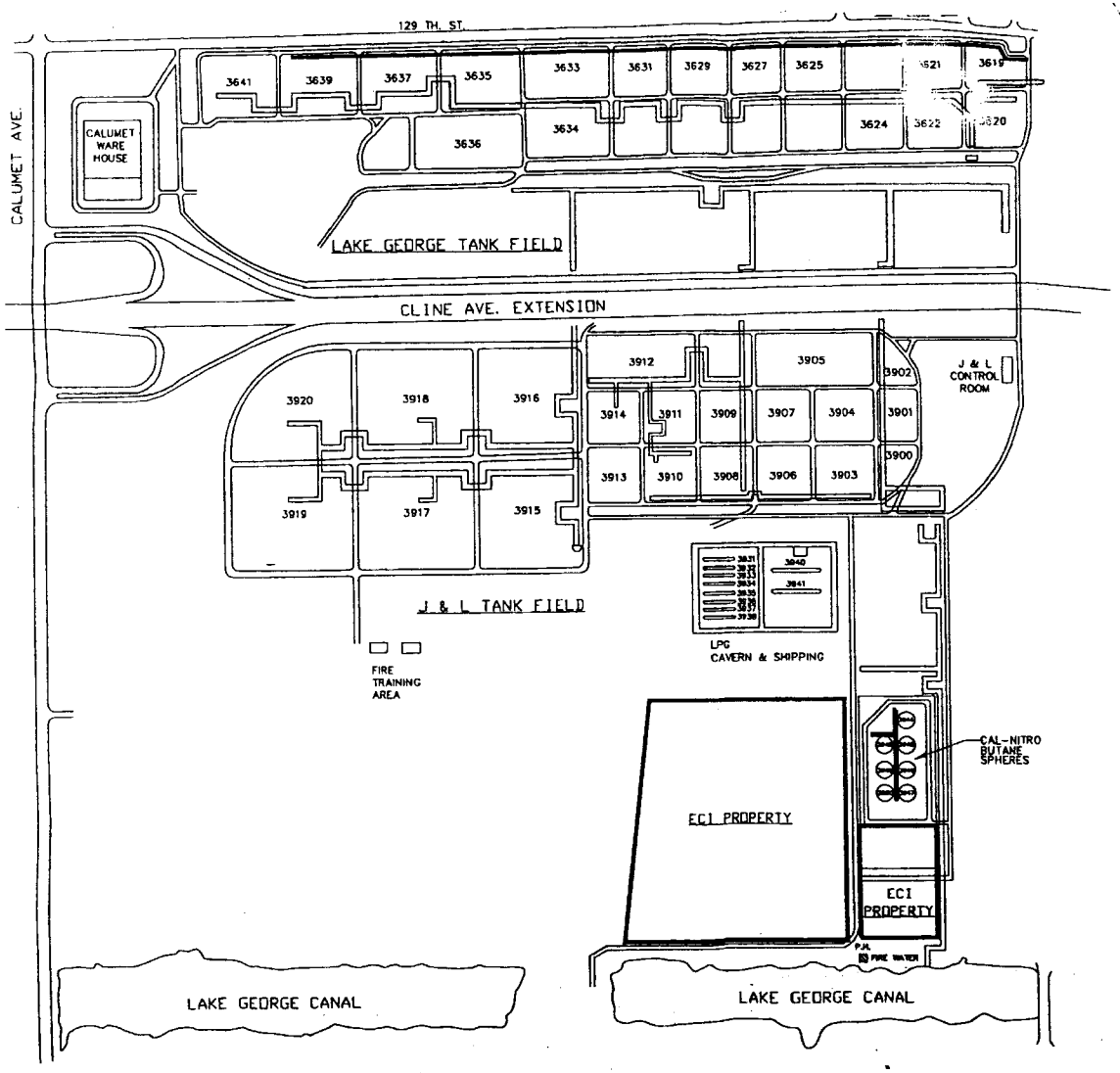
TANK DIKE AND ROAD CROSSINGS PIPING

ACAD v:APLOT s:1=1 C:\88C3114\FROMWHITY\STKFLD.dwg

Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

AMOCO WHITING REFINERY SOUTH TANK FIELD, SPTF, AND DOCK AREA

DESIGN: AWI	SCALE: SHOWN	PROJECT NO. 88C3114	FIG. NO. 2-2
DRAWN: LM	DATE: 5/9/96		



LEGEND

PIPE ALLEY

TANK DIKE PIPING

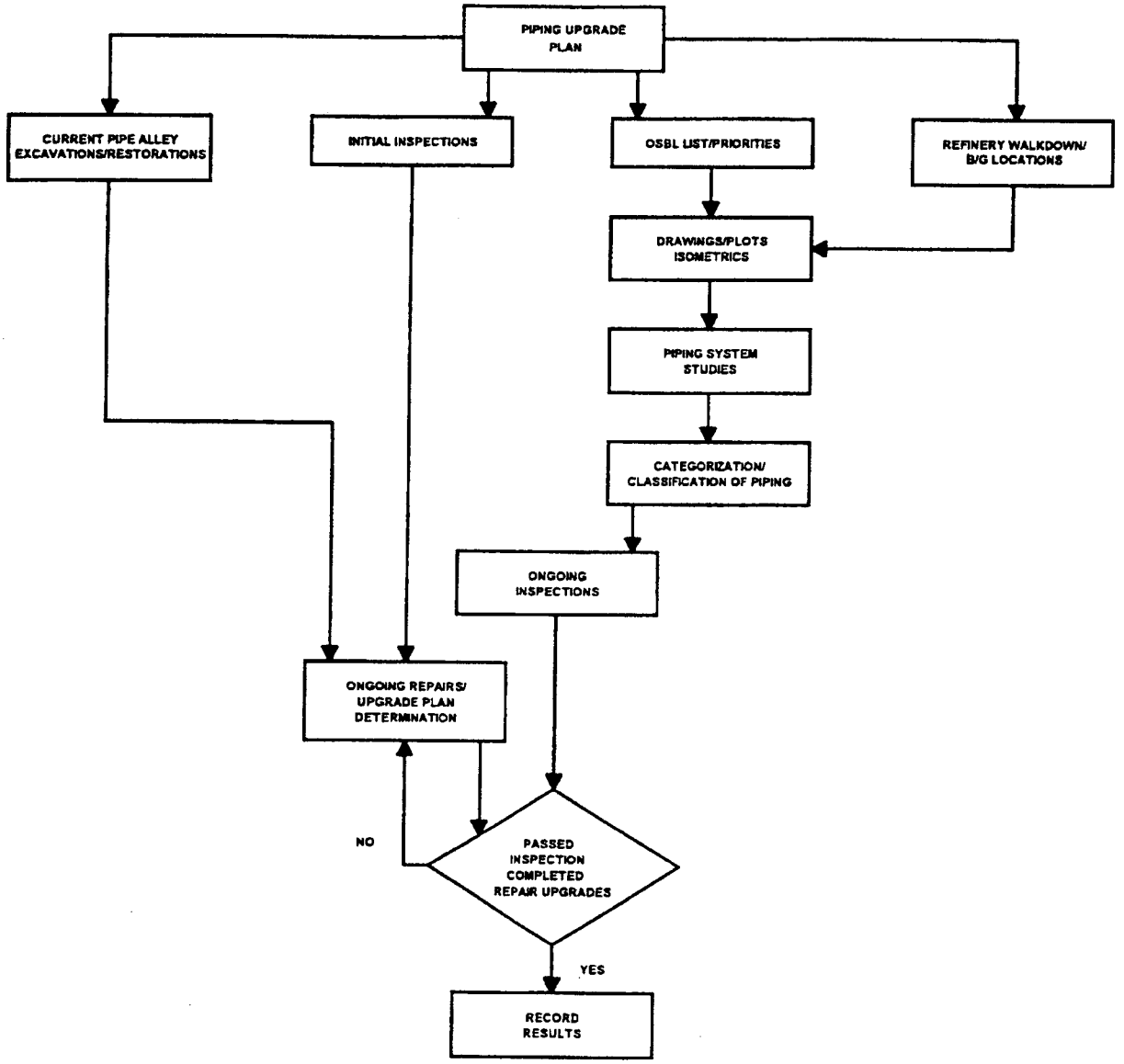
Woodward-Clyde Consultants

ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

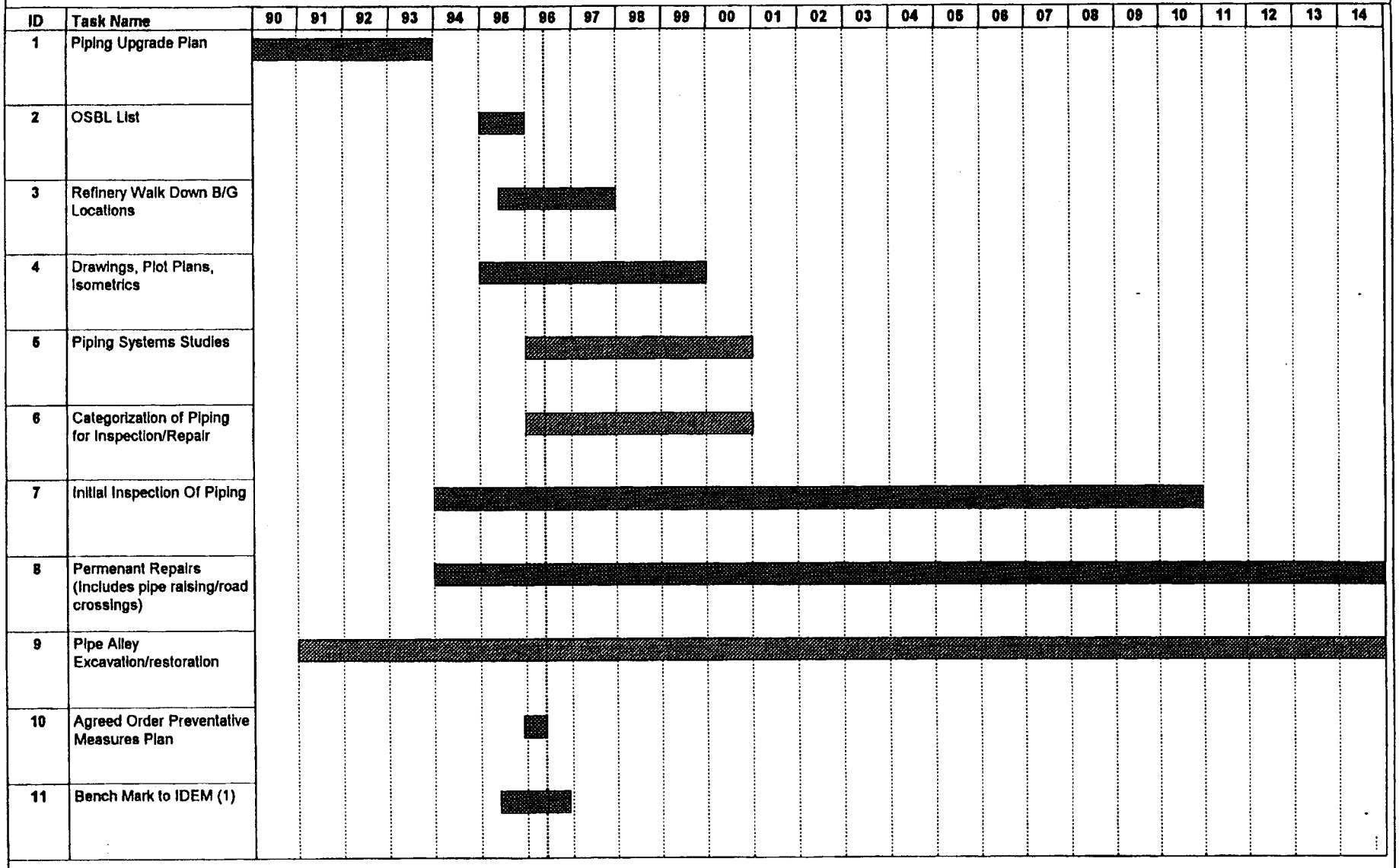
AMOCO WHITING REFINERY PIPE ALLEYS AND TANK DIKE PIPING FOR THE J&L SITE

DESIGN: CKY	SCALE: NONE	PROJECT NO. 88C3114	FIG. NO. 2-3
DRAWN: LO	DATE: 9/14/98		

FIGURE 2-4
OSBL PIPING PREVENTATIVE MEASURES
FLOW CHART



AMOCO WHITING REFINERY PIPING PMWP SCHEDULE

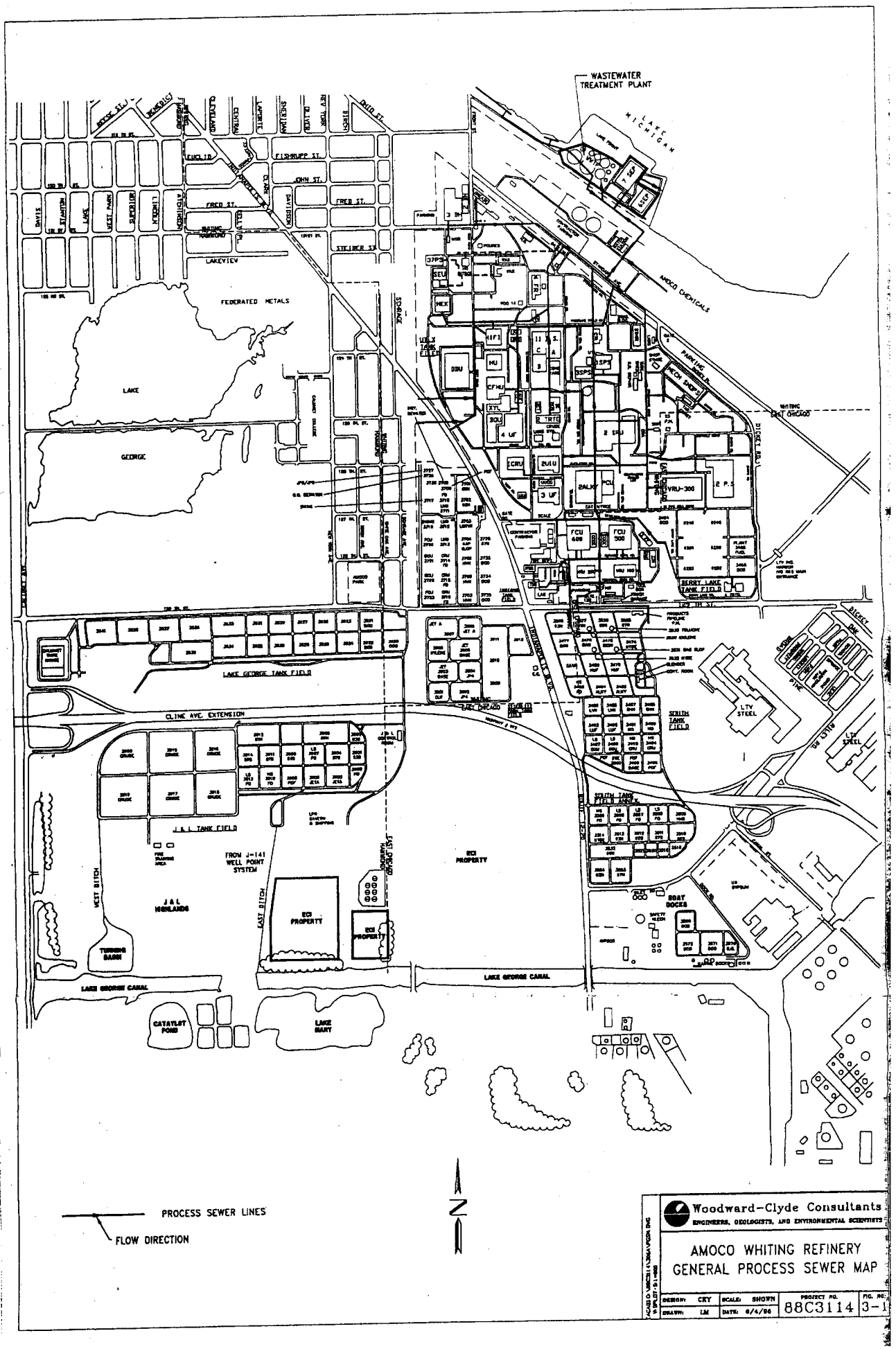


Notes: (1) Includes lineal feet of road crossings underground and at grade piping.
To be submitted with final report

Task Summary

Milestone

D:\88C3114\306A\pmpfig25.mpp Wed 5/29/96 WOODWARD-CLYDE CONSULTANTS FIGURE 2-5



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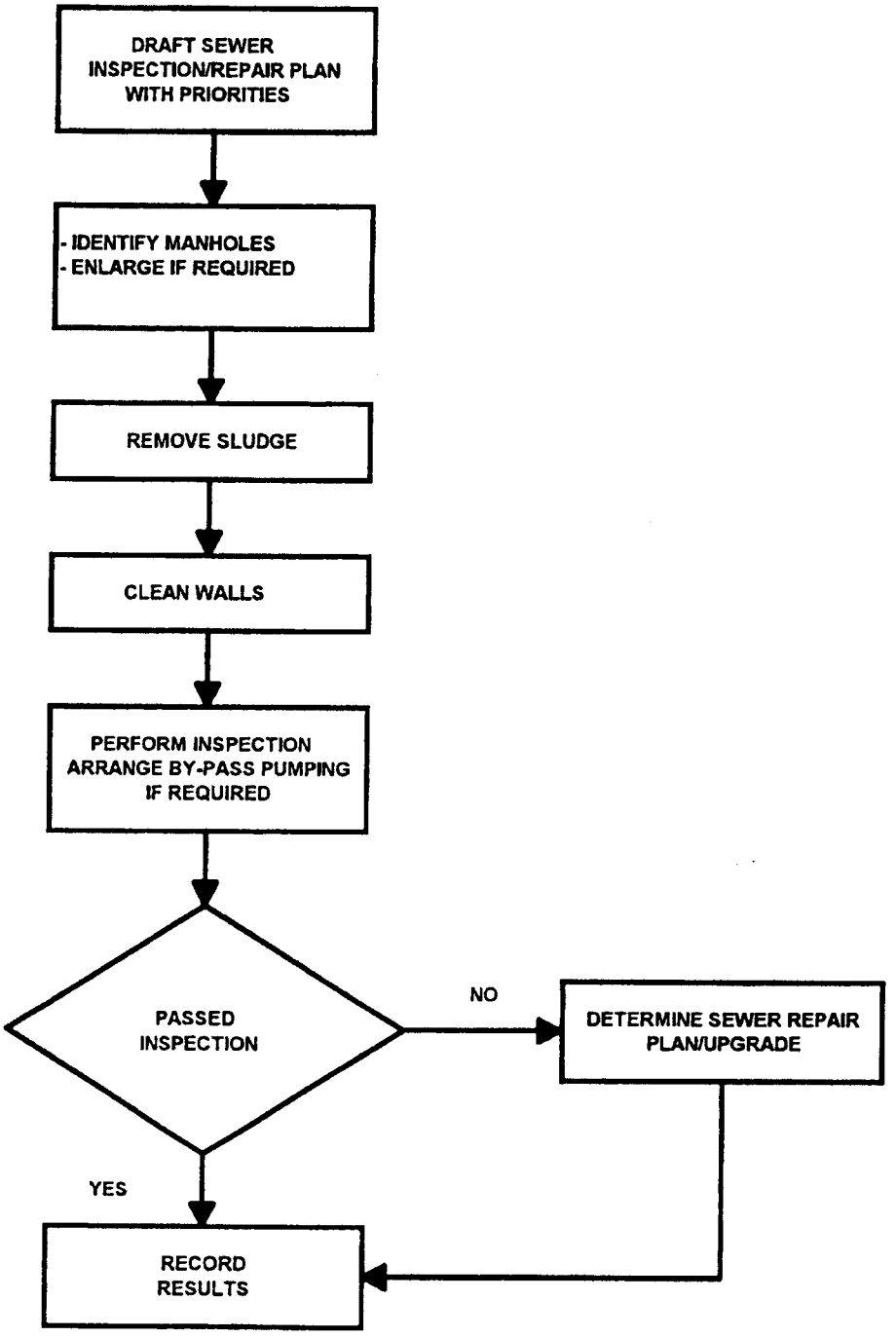
AMOCO WHITING REFINERY
GENERAL PROCESS SEWER MAP

DESIGN: CKY	SCALE: SHOWN	PROJECT NO. 88C3114	FIG. NO. 3-1
DRAWN: LM	DATE: 6/4/96		

FIGURE 3-2
PROCESS SEWER PREVENTATIVE MEASURES
FLOW CHART



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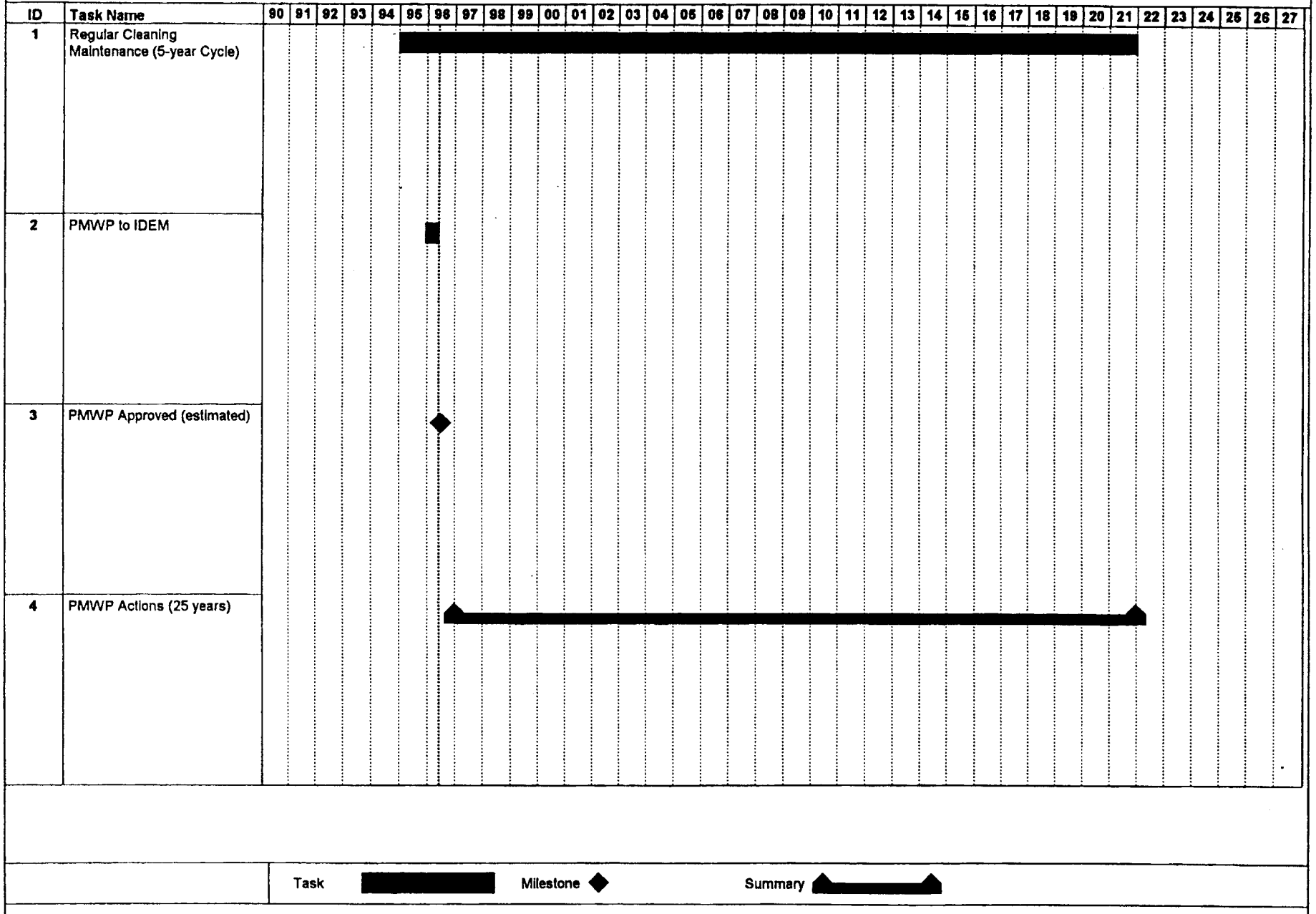
AMOCO WHITING REFINERY PROCESS SEWER PMWP SCHEDULE



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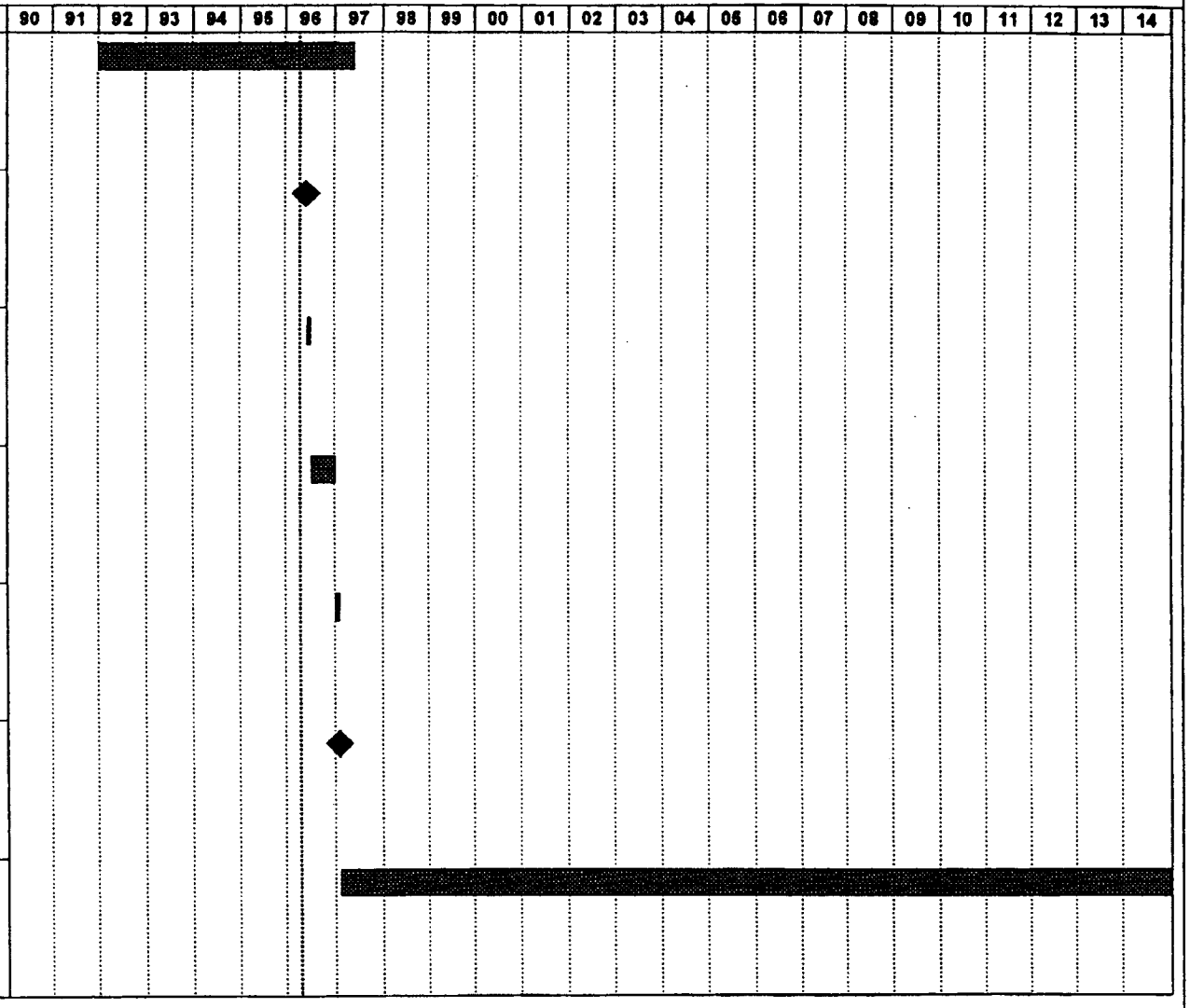
WOODWARD-CLYDE CONSULTANTS

FIGURE 3-3

PETROLEUM RELEASE
PREVENTATIVE MEASURE GENERAL SCHEDULE

ID	Task Name	Schedule
1	Regular Monitoring / Maintenance	Ongoing
2	Submit Preventative Measures Work Plan	6\5\96
3	Approval By IDEM (ESTIMATED)	Estimate 30 Days
4	Final Report On Implementation	180 days from approval
5	Approval By IDEM	Estimate 30 Days
6	Completion of Preventative Measures	At final report approval
7	Continued Routine Inspections and Actions	Ongoing



Task Milestone Summary

D:\88C3114\306A\pmpfig61.mpp 4/12/96

WOODWARD-CLYDE CONSULTANTS

FIGURE 6-1

APPENDIX 3-1

Detailed Process Sewer Preventative Measures Workplan

MIDDOUGH ASSOCIATES INC.
ENGINEERS AND DESIGNERS

AMOCO (AO559)

WHITING REFINERY

CLEANING, INSPECTION AND REPAIR

PROCESS SEWER - PLAN OF ACTION

TABLE OF CONTENTS

AMOCO
Whiting Refinery
Cleaning, Inspection and Repair
Process Sewer - Plan of Action
Middough Reference No. AO559

SECTION I SUMMARY

The Whiting Refinery of Amoco has requested Middough Associates to develop a Plan of Action for the cleaning, inspecting and repairing of its main process sewer runs.

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Whiting Refinery
Cleaning, Inspection and Repair
Process Sewer - Plan of Action
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SECTION II PURPOSE AND INTRODUCTION

The Plan of Action for the Whiting Refinery (Plant) Process Sewer System will include, cleaning, inspecting and repairing of the Plant's main process sewers. The main process sewers have been identified by the Plant. A Key Plan of the main sewer lines are shown on Figure II-1 (Whiting Refinery Process Sewer System January, 1994). The manholes, junction boxes and sumps will also be included in the Plan.

The branch lines tributary to the Process Sewer System are not part of this Plan. Their integrity is maintained under the Plant's on-going maintenance program.

The Process Sewer System consists of approximately six miles of 18" to 84" diameter sewers The type of material installed includes steel, cast iron, acid brick within concrete and concrete pipes. The installation of these sewers date back to the 1930's, 1940's and 1950's with modifications and repairs through the more recent years.

The Process Sewer System carries unit process water, stormwater, groundwater and liquids from dewatering processes to Amoco's Lakefront Wastewater Treatment facility.

Individual Process Sewer System segments may be above or below the local groundwater level. The local groundwater level fluctuates with the different seasons of the year. The Plant has groundwater monitoring wells from which the groundwater variation may be determined.

SECTION II PURPOSE AND INTRODUCTION (Cont.)

This Plan of Action is to be used as a guide for the Plan reviewers, data reviewers and engineers involved with the inspection, evaluation and repair of the sewer system at Whiting Refinery. Its purpose is to outline consistent inspection procedures and to provide systematic guidance for recording physical information and observations during closed-circuit television (CCTV) and manual inspections (including physical entry). The application of this Plan will establish consistent information for any recommended repairs to the main process sewers at Whiting Refinery.

This Plan identifies a sewer inspection process, including scheduling, pre-inspection procedures, cleaning, documenting observations, identifying defects for repair, and applying state-of-repair criteria. Photographs and schematic drawings of sewer structure defects along with written descriptions will assist inspectors in properly identifying and consistently recording their observations.

CCTV inspection is the principle method used to assess the condition of a sewer system. It provides a means to observe the condition of the internal surface of sewer pipes. CCTV equipment is also used to inspect manholes to make a general assessment regarding their defects and condition. Uncertainty about the condition or extent of defects is verified through physical entry and manual inspection, if possible. Other sewer structures are usually inspected by physical entry as well. If uncertainty exists as to state-of-repair of a manhole or other structure, a physical entry will be performed.

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SECTION III PRE-INSPECTION

Various preparatory activities are required before performing sewer inspections. These activities include raising manholes to grade, exposing buried junction box lids, cleaning, scheduling the sewer bypass and compilation of information to assist the inspectors. This Section outlines such preparatory activities.

Sewer inspections are scheduled in accordance with the criteria described in Section X, and as established by the Plant. A Sewer Structure Information Package is to be compiled prior to each inspection. This information should include the following basic data regarding the inspection:

- Inspection Site Map
- Pipeline Size, Length and Type of Material
- Manhole Identification Number
- Other Sewer Structure Identification Number
- Sewer Structure Physical Data
- Amoco Drawing Numbers
- Sewer Structure Priority Rating
- Relationship of Sewer Structure to Groundwater

When the Inspection Team receives the Sewer Structure Information Package, the Inspection Planner works with the Amoco Representative to provide details for the inspection such as:

- Desired Execution Dates and Times
- Contact and Phone Number
- Site Conditions and Constraints
- Environmental Contacts and Phone Numbers
- Safety Permit and Procedure Requirements
- Shutdown/Bypass Requirements
- Manufacturing/Process Contingency Plan (Contingency Plan)

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SECTION IV CLEANING

Sewer structures must be cleaned before CCTV and/or manual inspection is performed. Cleaning is necessary to remove debris and scale buildup from structure walls and inverts, allowing a clear view of the internal condition of the line. This Section describes the cleaning equipment, methods and procedures to be used.

Equipment and Methods

Cleaning is performed using one of the following methods:

- **Hydrocleaning** uses a high velocity, high pressure water system to clean sewer pipelines. Nozzles are moved through the pipeline to produce a scouring effect that removes scale and debris. The scoured material is accumulated at manholes and removed with a vacuum system or pumped to the decant box. This is the preferred method of cleaning pipelines.

- **Mechanically Driven Equipment (Bucket Machine) Cleaning** involves pulling a bucket through a pipeline to remove large deposits of silt, sand, gravel, and other solid materials that cannot be removed by hydrocleaning alone. As the bucket is pulled through the pipeline, it scrapes materials from the invert and collects them in the bucket. The bucket is raised to the surface and emptied, and the process is repeated. Hydrocleaning is performed after bucket cleaning to flush out any remaining materials.

- **Hand Cleaning and Flushing** is used to remove debris from the sewer structure when hydrocleaning or mechanical cleaning methods are not successful or if a structure cannot be accessed with that equipment. The hand cleaning process consists of using hand tools assisted with high pressure water and manually removing debris from the structure.

Procedures

Cleaning of the existing Process Sewer System, the 18" to 84" diameter pipes, manholes, junction boxes and sumps is necessary prior to any inspection or repairs. In the past, the cleaning process has been accomplished by "Step Cleaning", which involves hydroblasting, and pumping to a decant box. Liquid from the decant box is pumped back to the process sewer and solids disposed of by an approved method. The sewers have typically been found to be up to 1/4 full of sludge on the section upstream of a manhole. The portion just downstream of a manhole is typically reasonably clean. Other Amoco approved cleaning methods may also be used.

SECTION IV CLEANING (Cont.)

Procedures (Cont.)

Caution must be taken when an obstruction is encountered during cleaning operations to avoid damaging the sewer. Cleaning activities should be terminated if either of the following conditions, which are indicative of possible pipe damage, is observed:

- Large quantities of fresh soil or pipe bedding material are being removed.
- Pieces of pipe material are being removed.

In general, cleaning of pipelines will proceed in the downstream direction. Debris in the pipeline is removed at a downstream manhole. If a blockage is encountered, the cleaning equipment can be set up in the downstream manhole and cleaning can be attempted again moving upstream. If a blockage cannot be removed immediately, the location should be noted for future action. Inspection will proceed where possible. Otherwise, cleaning and inspection will be rescheduled using other mechanical cleaning methods or excavating to remove blockage.

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SECTION V CLOSED-CIRCUIT TELEVISION (CCTV) INSPECTION

The interior conditions of pipelines are inspected primarily through the use of closed-circuit television (CCTV). The CCTV equipment is also used to augment other inspections as noted in later chapters. For larger diameter pipe, the CCTV camera rides through the pipe on a self-propelled tractor, or is pulled through the pipeline by a winch controlled by a winch operator. A hand-fed camera may be pushed by hand through smaller diameter pipe.

The camera operator views the pipeline interior on a television screen and records the inspection on video tape. The pipe defect data is noted on a report form and recorded in the data logger. This procedure is used to identify structural deficiencies, sags in pipe segments, joint defects, protruding or defective lateral connections, debris, obstructions, infiltration, other defects or previous repairs. It is also used to verify locations of lateral connections and pipeline footage. This Section discusses the equipment used for CCTV inspection and appropriate inspection procedures.

CCTV Inspection Equipment

CCTV inspection is performed using camera systems designed specifically for pipeline inspection. A typical system has the following major components:

- Transport Winches or a Tractor
- Single-Cable Video Camera and Lighting Control
- Video Tape Recorder (VCR)
- Data Logger
- CCTV Inspection Trailer

The data logger is an electronic device used specifically to record field observations. Defects are recorded using pre-programmed keys on the electronic keyboard. The information is stored on a computer disk for later transfer to a database.

Verification of Conditions

The pipeline location and attributes such as diameter, length, and pipe material should be verified before inspection begins. If deemed necessary, the pipeline diameter can be verified by physical measurement in the upstream or downstream manhole. The suitability of CCTV inspection of the pipeline is verified during the first pass with the video inspection camera.

SECTION V CLOSED-CIRCUIT TELEVISION (CCTV) INSPECTION (Cont.)

Verification of Conditions (Cont.)

The sewer should be dewatered so that the pipeline invert is clearly visible. The camera lens must remain above any visible water level and may submerge only while passing through clearly identifiable pipe sags. If fog or steam is present, it will be removed by using fans, blowers, or vacuum trucks so that acceptable televising can proceed.

Inspection

During inspection, the entire pipe circumference is inspected for possible defects. It is usually necessary to conduct a "two-pass" inspection, in which the camera passes through the pipeline twice. The pipe invert is inspected during the first pass when the camera travels forward, and the pipe crown is inspected during the second pass when the camera is pulled backward. Whenever possible, the inverts of manholes are inspected with the upstream pipe segment.

The camera should travel at a moderate pace. Additionally, care should be taken when obstructions are encountered to avoid damage to the pipe or camera. If the camera is not able to negotiate an obstruction, the inspection operation should be set up at the opposite manhole and the pipeline televised in the reverse direction toward the obstruction.

Data Logging

The inspector shall record the defects and other pertinent information on a report form and to the data logger. The data log should include inspection information (event number, segment number, date and time of inspection, inspector, and direction of camera movement, if the first pass is not in the downstream direction), as well as all important features such as manhole identification number, pipeline size, laterals, defects, and any other pertinent inspection details.

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SECTION VI MANUAL INSPECTION

A manual inspection is used to observe the interior conditions of sewer structures when the structure design and/or operating conditions are not suitable for standard CCTV inspection procedures or when a "hands-on" examination is preferred. A manual inspection may be performed for pipelines, manholes, or other sewer structures. As discussed in this chapter, manual inspection includes both physical entry into a secured sewer structure and the use of remote methods to inspect manholes. The physical entry procedure involves visual inspection of the structure by inspection personnel and the recording of observations on either videotape or still photographs. Remote, manual inspection of manholes involves "puppetting" a CCTV camera into the manhole to observe the interior surfaces. This Section outlines the necessary equipment and procedures to be used during both types of manual inspections.

Equipment

When physical entry into a sewer is necessary, the equipment required to perform a manual inspection may include:

- Blowers for Ventilation
- Atmospheric Monitoring Equipment
- Access Ladders
- Tripod and Winch for Safety Egress
- Personnel Safety Equipment
- Communications Equipment
- Lighting Equipment
- Tape or Rule for Making Measurements
- Photographic Recording Equipment (Still Camera and Hand-Held Video Camera)
- Scraper to Remove Debris from Sewer Structures
- Various Handtools

The CCTV camera and equipment may be used for remote or manual inspection of manholes and other structures.

SECTION VI MANUAL INSPECTION (Cont.)

Preparation for Inspection

Before manual inspection, the sewer structure must be cleaned and dewatered as discussed previously. The structure will be dewatered so that the invert is clearly visible. If physical entry is necessary, the structure to be inspected shall be thoroughly vented before and during the inspection process. Venting of pipelines consists of removing the manhole covers on the upstream and downstream ends of the pipeline and providing forced ventilation with blowers. Both intake and exhaust blowers may be required to provide sufficient ventilation.

The sewer atmosphere shall be tested using atmospheric monitoring equipment before entry by personnel or before inserting equipment into the sewer structure. Personnel shall not enter the structure unless all criteria for safe entry, and for work in confined space are met.

Verification of Conditions

Upon entry into a structure, the inspection team should verify the structure dimensions, materials of construction, cleanliness, water level, and structure integrity. If the structure is sufficiently clean and dewatered, the inspection can proceed. If cleaning and dewatering are not sufficient, the inspection team should exit the structure and corrective action should be taken to prepare the structure for inspection. If the sewer structure appears to be unsafe for a physical entry inspection, the inspection team should immediately exit the structure until arrangements are made to provide for safe entry.

Inspection

The inspection team for a physical entry inspection consists of a **minimum** of three persons: one who enters the sewer structure, and two who remain above ground to provide support. Two-way communication can be used to keep team members in constant contact. Proper lighting is maintained by inspection personnel to provide sufficient illumination to observe the condition of the structure. Observations are recorded on either videotape or still photographs. For pipeline inspections, the inspector walks slowly through the pipeline from one manhole to the next, recording observations along the way.

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SECTION VI MANUAL INSPECTION (Cont.)

Inspection (Cont.)

The remote inspection procedure for manholes is performed by "puppetting" a CCTV camera into the manhole. The camera is lowered into the manhole using a support cable and rotated to view the interior surfaces. If uncertainty about the presence or extent of defects is noted, the manhole may be physically entered to perform a more detailed inspection.

SECTION VII PIPELINE DEFECT IDENTIFICATION

To effectively evaluate the condition of sewer pipelines, it is important to understand visual observations relative to actual defects. This chapter summarizes the pipeline inspection methods and provides a set of pipeline defect definitions to provided a common base for classification of observed defects.

Inspection Methods

Defects on the internal surfaces of pipelines are identified during either CCTV or manual inspection. During CCTV inspection a camera is either pulled, pushed or transported on a tractor unit through the pipeline. The camera operator views the pipe interior on a television screen and records pipe defect data. Manual inspection is performed when the structure design or operating conditions are not suitable for CCTV inspection or when a "hands-on" examination of the pipeline is desired. During manual inspection, an inspector enters a dewatered pipeline to inspect the condition of the pipe. Results are recorded on either videotape or still photographs.

Defect Classification

A summary of defects that may be observed in sewer pipelines will be developed. Anticipated defects applicable to a specific pipe material will be tabulated.

The tabulated information will consist of:

- Type of Structure (and material if defect is material-specific)
- Type and Definition of Defect
- Severity of Defect
- Photo of Defect (if available)
- Schematic Drawing of Defect (as applicable)

SECTION VII PIPELINE DEFECT IDENTIFICATION (Cont.)

Defect Classification (Cont.)

The sewer pipeline material groups are subject to similar defects within a group.

The material groups include:

- Clay/Concrete;
  Vitrified Clay Tile Pipe;
  Concrete and
  Lined Concrete (Protective Inside Liner, Such as Tile Liner Plates)
- Cast/Ductile Iron
- Thin Wall Metal;
  Stainless Steel;
  Steel; and
  Alloy
- Tile Block

Other sewer pipe materials may be identified during inspection will be grouped and evaluated in a consistent manner.

If a sewer segment was rehabilitated or upgraded with a structural liner, the liner becomes the primary pipe. All subsequent inspections are performed for the liner only. Examples of structural liners include cured-in-place (instituform®) and slip linings of plastic or metal.

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SECTION VIII MANHOLE DEFECT IDENTIFICATION

The Whiting Refinery Process sewer system was constructed using a wide variety of construction methods and materials. To provide an effective evaluation of the manhole (junction box or sump) conditions and state-of-repair, it is important to know or identify: the construction methods and materials, to ascertain the reference groundwater level and normal wastewater exposure areas, and to evaluate the exposed areas with regard to state-of-repair criteria. This Section outlines the manhole inspection procedure and provides potential manhole defects to assist the inspector in identifying and recording defect information.

Inspection Methods

Manholes are inspected by manual methods, as described in Section VI, either by using a remote camera or by physically entering the manhole.

If uncertainty exists about the presence or extent of defects, the manhole may be physically entered to perform a more detailed inspection.

Inspection Procedure

The inspection procedure consists of the following steps, each of which is described below in further detail:

- Identification of construction methods and materials.
- Identification/Reference to groundwater level.
- Determination of normal wastewater level.
- Identification of defects.
- Determination of state-of-repair.
- Recommendations for repair.

Construction Methods and Materials

The first step in the inspection procedure is to identify the construction method and materials or combinations of materials for each manhole component. Typical manhole inspection identifies:

- General Manhole Configuration
- Component Materials
- Construction Features

SECTION VIII MANHOLE DEFECT IDENTIFICATION (Cont.)

Construction Methods and Materials (Cont.)

The above information is recorded and documented as part of the Pre-Inspection Information package. In general, construction information need only be recorded during the pre-inspection of the manhole, then verified during subsequent inspections.

Wastewater Exposure/Groundwater Level

Wastewater exposure conditions will be referenced and noted with respect to groundwater level.

Defects

Types of manhole defects which may be encountered will be summarized and classified prior to or during the Pre-Inspection of the Process Sewer System. Defect data will be recorded on a Manhole Inspection Form and in the electronic data logger. Defect data are to be noted for each manhole component: base manhole construction, lining on walls (if applicable), benchwall, invert, drop leg, and seals. The manhole invert is sometimes inspected as part of the pipeline inspection. Additional inspection information entered in the data logger may include date of inspection and inspector.

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SECTION IX STATE-OF-REPAIR

During the sewer and manhole inspection process the inspectors are required to evaluate the sewer state-of-repair based on the presence of observed defects. The type and extent of defect along with the location shall be documented on video or a still photograph shall be included with the recorded defect.

This Program is anticipated to require 20 years to complete. The sewer cleaning, inspection and repair will occur each year for a four to six month duration. It is anticipated that each year's defects be repaired that same year.

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SECTION X INSPECTION SCHEDULING

The schedule for of cleaning, inspection and subsequent repair is identified in this Section. Prior to any inspection:

1. The Process Sewer System, main lines manholes/junction will be documented through existing drawings and visual observations during the Pre-Inspection Phase.

2. Raising manhole lids to grade or exposing the lids for removal to accomplish the cleaning inspecting and repair.

3. The sewers and manholes/junction boxes and sumps will be cleaned.

4. The inspection procedure will be performed during the summer season, typically during the dry weather time of year.

5. The inspection data will be documented and evaluated. Any items which can be repaired immediately while that section of sewer line is cleaned and/or inspected will be performed at that time.

To established the order as to which segments (sewer lines) of the Process Sewer System will be cleaned, inspected and repaired there are a variety of items to consider. The following items, along with other Plant issues and to be received prior to setting the schedule.

- Material of construction (i.e., brick, concrete, steel).
- Type of wastewater stream.
- Relative elevation with respect to groundwater.
- Age of system.
- Furthest upstream segment first.
- Ease of accessibility.
- Amount of debris in the sewer.

The established order for cleaning, inspection and repairing will need to be a living and flexible document as additional system information becomes available and/or changes to the system occur.

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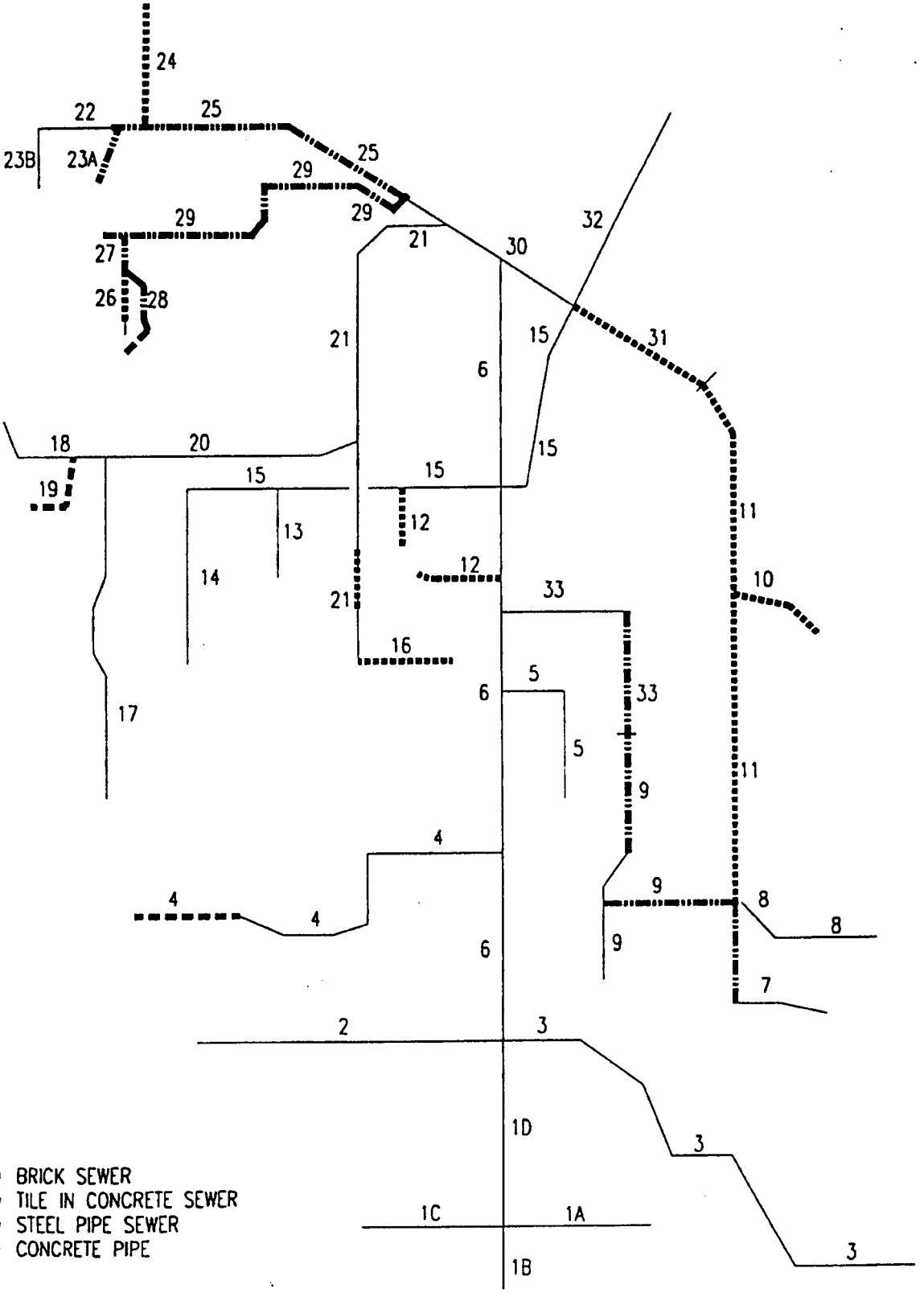
SECTION XI DATA MANAGEMENT

Data collection during sewer inspections will be compiled for further review and future maintenance or inspection. CCTV and manual inspection observations are recorded by the field inspection team and a hardcopy provided for record. Hardcopy data such as photographs, sketches, and field information will be compiled into a yearly report following that year's cleaning, inspecting and repairing program.



KEY PLAN

SCALE: NTS

FIGURE II-1

MIDDOUGH ASSOCIATES INC.
ENGINEERS AND DESIGNERS
CLEVELAND, OHIO # A0559